

Montgomery County Parking Facility Design Guide



August 2026 Draft

 **Montgomery Planning**

Acknowledgments

Staff Team

Eli Glazier, Montgomery County Planning Department

Richard Brockmyer, AICP, Montgomery County Planning Department

Alex Rixey, Montgomery County Planning Department

Prepared By

Toole Design Group

Funding

This guide was developed with funding from the federal Safe Streets and Roads for All (SS4A) program, the goal of which is to reduce and ultimately eliminate roadway deaths and serious injuries on U.S. roads by funding safety improvements and planning efforts at the local, regional, and Tribal level.

All images and graphics are provided by Toole Design Group or Montgomery County unless otherwise noted.

This guide contains information intended to be used as an input during the design process; however, field verification, site condition assessments, engineering analysis, and design are necessary prior to implementing the guidance contained herein.

Table of Contents

Acknowledgments..... i

List of Tables.....iv

Acronymsv

Key Terms.....v

Section 1: Introduction1

1.1 Purpose 2

1.2 Organization..... 2

1.3 Background 2

1.3.1 Montgomery County and Vision Zero 2

1.4 Functions of Parking Facilities 3

1.5 Impact of Parking Facility Design 3

1.6 Issuing Agency 4

1.6.1 Requirements..... 4

1.6.2 Best Practice Guidance 4

1.7 Required Standards and Guidance Referenced in Guide 5

Section 2: Key Parking Facility Traffic Safety and Accessibility Issues.....7

2.1 Key Safety Issues..... 8

2.2 Key Accessibility Issues 9

Section 3: Principles of Safe Parking Facility Design..... 10

Section 4: Surface Parking Lots12

4.1 Planning Considerations 13

4.1.1 Land-Use Context..... 13

4.1.2 Future Development..... 13

4.2 Layout 14

4.2.1 Layout Requirements 14

4.2.2 Layout Guidance 15

4.3 Pedestrian Network Elements 18

4.3.1 Accessible Routes..... 18

4.3.2 Accessible Route Guidance..... 19

4.3.3 Walkways and Sidewalks..... 20

4.3.4 Crosswalks 24

4.3.5 Curb Ramps..... 25

4.3.6 Drive Aisles as part of the Pedestrian Network..... 25

4.4 Bicycle Network Elements..... 26

4.4.1 Shared Spaces..... 26

4.4.2 Bikeways..... 26

4.5 Bicycle and Micromobility Parking 27

4.5.1 Bicycle and Micromobility Parking Requirements 27

4.5.2 Bicycle and Micromobility Parking Guidance 27

4.6 Motor Vehicle Network Elements 28

4.6.1 Driveways 28

4.6.2 Ring and Circulation Roads 30

4.6.3 Building Frontage Roads..... 33

4.6.4 Drive Aisles 35

4.7 Motor Vehicle Parking 38

4.7.1 Motor Vehicle Parking Requirements..... 38

4.7.2 Motor Vehicle Parking Guidance 39

4.8 Loading Zones..... 40

4.8.1 Loading Zone Requirements 40

4.8.2 Loading Zone Guidance 40

4.9 Other Design Considerations 41

4.9.1 Lighting 41

4.9.2 Personal Security 42

4.9.3 Green Infrastructure..... 43

4.9.4 Stormwater Management..... 44

4.9.5 Incorporating Human-Scale Design 45

4.9.6 Maintenance..... 45

Section 5: Structured Parking Garages47

5.1 Layout 48

5.1.1 Layout Requirements 48

5.1.2 Layout Guidance 48

5.2 Pedestrian Network..... 49

5.2.1 Pedestrian Network Requirements 49

5.2.2 Pedestrian Network Guidance..... 49

5.3 Bicycle Parking 50

5.3.1 Bicycle Parking Requirements..... 50

5.3.2 Bicycle Parking Guidance 50

5.4 Entry and Exit Points 51

5.4.1 Entry and Exit Point Requirements 51

5.4.2 Entry and Exit Point Guidance..... 51

5.5 Other Design Considerations 52

5.5.1 Lighting 52

5.5.2 Placemaking..... 53

5.5.3 Personal Security Guidance 53

Works Cited 54

Works Cited 55



List of Figures

Figure 1	Risk of death by age and motor vehicle speed	8
Figure 2	The Safe System Approach	11
Figure 3	Recommended spacing between internal circulation routes	13
Figure 4	Parking lot located at the back of a building	15
Figure 5	Bicycle parking near building entrances	15
Figure 6	Pedestrian desire lines	16
Figure 7	Building frontage road (BFR) terminated with bollards	16
Figure 8	Driveway consolidation: before and after	17
Figure 9	Pedestrian network elements.	18
Figure 10	Example of accessible parking located on the shortest possible route to front entrance 19	
Figure 11	Wayfinding to accessible entrance	20
Figure 12	Aisles parallel to building frontage and centerwalk.	21
Figure 13	A wide landscaped setback makes it difficult for pedestrians to access the centerwalk to and from parking spaces	22
Figure 14	Sidewalk-level centerwalk	22
Figure 15	Street-level centerwalk protected by wheelstops	22
Figure 16	Centerwalk designated by pavement markings	22
Figure 17	Street zones diagram	23
Figure 18	High-visibility continental style crosswalk	24
Figure 19	Directional curb ramp at a crossing	25
Figure 20	A person walking in the drive aisle	25
Figure 21	Bike marking in parking lot	26
Figure 22	Bicycle parking that accomodates different bike types	27
Figure 23	Illustrative circulation diagram depicting driveway locations	28
Figure 24	Driveway with sidewalk continuing across driveway opening	29
Figure 25	Bicycle conflict markings.	29
Figure 26	Truck turning apron	29
Figure 27	Illustrative circulation diagram depicting ring and circulation roads	30
Figure 28	Curb extensions in a parking lot	31
Figure 29	Chokers	31
Figure 30	Roundabout in a parking lot	31
Figure 31	Pedestrian refuge island	31
Figure 32	Speed table	31
Figure 33	Rectangular Rapid Flashing Beacons	32
Figure 34	Illustrative circulation diagram depicting a BFR	33
Figure 35	BFR designed as shared space	33
Figure 36	Raised crossing across BFR	34
Figure 37	Stormwater management on end islands.	34
Figure 38	Roundabout with a mountable center island	35
Figure 39	Aisles arranged perpendicular to building frontage	36
Figure 40	Landscaped dividers alternating between bays	37
Figure 41	Accessible parking requirements	39
Figure 42	Differences between back-in angle, perpendicular and front-in angle stalls.	39
Figure 43	Event lighting demonstrates how warm lighting and active use support perceived safety after dark	42
Figure 44	Before and after placemaking.	46
Figure 45	Vehicle circulation separate from parking aisles and pedestrian walkways	48
Figure 46	Dedicated walkways through parking garage roof	49
Figure 47	Wayfinding in parking garage	50
Figure 48	Bike parking near parking garage entrance.	50
Figure 49	Visibility at parking garage entries and exits	51
Figure 50	Example of insufficient lighting in parking garage impacting feeling of safety	52



List of Tables

Table 1 Required Guidance Documents and Standards for All Parking Facility Design in Montgomery County 5

Table 2 Required Guidance Document (Absent Written Exemption) 6

Table 3 Example Design Considerations by Land-Use Context 13

Table 4 Key Layout Requirements. 14

Table 5 Minimum Required Accessible Parking Spaces Specified in ADA Standards 208 14

Table 6 Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way 18

Table 7 Key Pedestrian Access Route Requirments for Parking Lot Areas in the Public Right-of-Way 19

Table 8 Key Walkway and Sidewalk Requirements 20

Table 9 Key Crosswalk Requirements. 24

Table 10 Key Curb Ramp Requirements 25

Table 11 Key Driveway Requirements 28

Table 12 Required Minimum Driveway Dimensions by Land-Use Type and Travel Direction 28

Table 13 Minimum Throat Length for Commercial/Industrial Entrances from State Roads 28

Table 14 Key Ring and Circulation Road Requirements. 30

Table 15 Minimum Drive Aisle Width by Parking Stall Orientation and Drive Aisle Direction of Travel 35

Table 16 Standard Spaces—Minimum Dimensional Requirements 38

Table 17 Compact Spaces—Minimum Dimensional Requirements. 38

Table 18 Key Accessible Parking Space Requirements 38

Table 19 Key Loading Zone Requirements. 40

Table 20 Key Lighting Requirements 41

Table 21 Key Green Infrastructure Requirements 43

Table 22 Key Stormwater Management Requirements 44

Table 23 Key Lighting Requirements 52

Acronyms

Acronym	Term
AASHTO	American Association of State Highway and Transportation Officials
ABA	Architectural Barriers Act
ADA	Americans with Disabilities Act
BFR	building frontage road
CPTED	Crime Prevention Through Environmental Design
EV	electric vehicle
IESNA	Illuminating Engineering Society of North America
MAC	Maryland Accessibility Code
MCDOT	Montgomery County Department of Transportation
MCDPS	Montgomery County Department of Permitting Services
MdMUTCD	Maryland Manual on Uniform Traffic Control Devices
MDOT SHA	Maryland Department of Transportation, State Highway Administration
Montgomery Planning	Montgomery County Planning Department
NFPA	National Fire Protection Association
PROWAG	Accessible Design Guidelines for Pedestrian Facilities in the Public Right-of-Way
RRFB	Rectangular Rapid Flashing Beacon
SS4A	Safe Streets and Roads for All



Key Terms



Term	Definition
accessible route	A continuous, unobstructed path connecting accessible elements and spaces that complies with ADA requirements for width, slope, cross slope, surface, and passing spaces. (ADA 2010 §402)
aisle (parking aisle)	A vehicular travel lane within parking lots that also functions as shared space with high pedestrian exposure and conflict risk.
angled parking	Parking arranged at an angle.
back-in angled stall	A parking configuration in which drivers reverse in and exit facing forward, which improves their visibility.
bioretention area	A landscaped stormwater feature that captures and filters runoff.
blended transition	A wraparound connection at a corner, or a flush connection where there is no curb to cut through.
building frontage road	A roadway adjacent to building entrances with high pedestrian activity.
backing crash	A crash involving a vehicle moving in reverse that strikes another vehicle, object, or person.
centerwalk	A designated pedestrian path between parking aisles that connects to building entrances.
circulation road	An internal roadway within a parking facility that distributes vehicular traffic between site access points and parking areas, typically designed for higher volumes and speeds than parking aisles, that is intended to reduce vehicle–pedestrian conflicts near building frontages.
commercial driveway	A driveway or vehicular access point that serves a commercial property or land use rather than a residential property.
compact parking space	A smaller parking space intended for compact cars to maximize parking capacity.
conflict point	A location where the traveler movements intersect, creating potential for crashes.
continuous sidewalk	A sidewalk that continues across driveways at sidewalk grade.
curb extension	A traffic-calming feature in which the sidewalk or curb is extended into the road-way—usually at intersections or mid-block crossings—to shorten pedestrian crossing distance, slow turning cars, and improve visibility between drivers and pedestrians.

Term	Definition
curb ramp	A ramp providing a transition between the sidewalk and roadway.
desire line	The natural route pedestrians prefer due to its directness and comfort.
drive aisle	A travel lane within a parking lot that provides access to parking stalls.
driveway	A paved connection for cars between a public roadway and site.
end island	A landscaped or curbed island located at the end of a parking bay that helps define the bay and parking aisles edges, slows turning cars, and preserves sight lines between drivers and pedestrians.
fire access road	A vehicular route that meets width and turning requirements for emergency access.
green infrastructure	Trees, permeable surfaces, and bioretention used to reduce runoff and heat.
landscape divider	A landscaped strip reducing cut-through driving and aiding stormwater management.
micromobility devices	Refers to the use of small, lightweight vehicles bicycles, e-bikes, electric scooters, electric skateboards, and electric pedal-assisted bicycles. Micromobility options are usually intended for individual use and can be human-powered or electric.
multiple-threat scenario	A hazard where a stopped cars blocks sightlines for another approaching car.
natural surveillance	A CPTED (Crime Prevention Through Environmental Design) strategy that improves visibility into and across a space through building orientation, windows, lighting, active uses, and landscape design so that people can readily observe one another and surrounding conditions.
parking facility	Off-street parking lots and parking garages
pedestrian access route	A continuous, unobstructed path within the public right-of-way that provides accessible pedestrian circulation and complies with PROWAG requirements for minimum clear width, grade, cross slope, surface, and accessible elements such as curb ramps and blended transitions. (PROWAG R301–R304)
pedestrian refuge island	A protected area between travel lanes that allows pedestrians to cross a roadway or drive aisle in two stages by providing a safe place where they can wait separated from moving traffic. Refuge islands are typically raised or otherwise delineated and designed to enhance visibility, reduce crossing distance, and improve pedestrian safety. They must meet PROWAG requirements for width, detectable warnings, and accessible connections. (PROWAG R302, R304)

Term	Definition
permeable pavement	A surface that allows water infiltration, reducing runoff.
personal security	The state of feeling protected from crime, harassment, assault, or profiling.
ring road	A type of circulation road that loops around a building or group of buildings, parking lot, or site edge to provide continuous internal circulation.
shared space	A low-speed environment where users mix and rely on design cues instead of separation.
shy distance	The space people instinctively maintain between themselves and surrounding vertical objects, including other people and physical features like building facades or walls.
speed table	A flat-topped raised section of roadway designed to slow car speeds while maintaining smooth car operation, often used to enhance pedestrian crossings and improve safety in low-speed environments.
standard accessible parking space	A parking space designed for vehicles used by people with disabilities, with required access aisles and signage.
standard parking space	A parking space designed for all vehicles without special accessibility features.
throat (driveway throat)	A driveway segment that organizes the movements of cars entering or exiting a site.
van-accessible parking space	A wider parking space designed to accommodate a wheelchair-accessible van with a lift or ramp equipment. It has a wider stall and access aisle, proper signage, and vertical clearance to accommodate a van. (ADA 2010 §502)
vehicle overhang	The portion of a parked vehicle that extends beyond the edge of a parking stall—typically over a curb, sidewalk, landscape area, or wheel stop.
walkway	A designated pedestrian path within a parking facility that provides safe circulation for pedestrians and that is physically or visually distinguished from vehicular areas by striping, curbs, wheel stops, or other approved methods.



1 Introduction



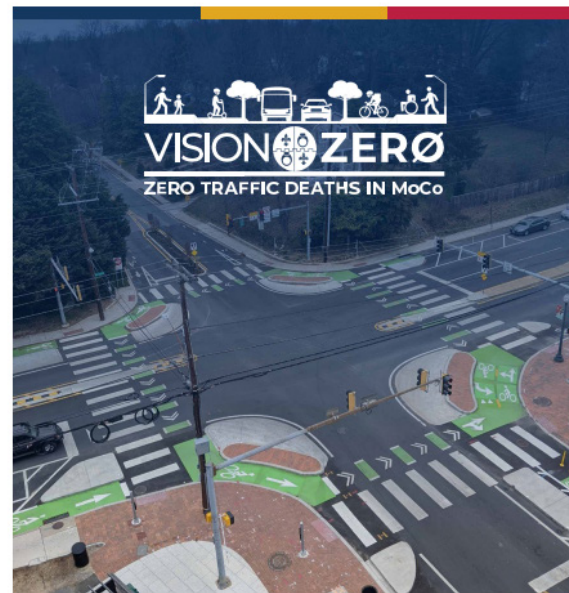
1.1 Purpose

This guide provides best practices for the design of off-street parking facilities, including surface parking lots and structured parking garages on both private and County-owned property.

Parking facilities are important features of Montgomery County’s transportation infrastructure. Parking facility design affects the way people access their destinations and influences injury risk and personal security.

This guide aims to:

- Promote safer parking facility designs, helping the county fulfill its commitment to Vision Zero.
- Support parking facility designs that are more accessible and comfortable for non-drivers and individuals with disabilities.
- Encourage parking facility designs that advance the county’s commitments to addressing climate change (including the urban heat island effect), clean water, and quality human-scale design that creates a sense of community and place.
- Prevent common mistakes and misunderstandings seen in development applications with parking facilities.



**OUR PLAN TO ELIMINATE FATALITIES AND
SERIOUS INJURIES ON OUR ROADS BY 2030**
2030 Action Plan • FY 24-25 Work Plan • July 1, 2023

1.2 Organization

This guide focuses on parking facility design strategies that reduce fatal and serious injury crashes while improving access and accessibility for pedestrians and users of micromobility devices, such as bicycles and electric scooters. In addition to safety, access, and accessibility, it also highlights broader design considerations—such as stormwater management and green infrastructure—at a high level, with references to more detailed resources.

The guide is organized as follows:

- **Part 1** introduces the guide, explains how it was developed and what authority it has, and lists the documents to which the guide refers.
- **Part 2** summarizes key traffic safety and accessibility issues in parking facilities.
- **Part 3** outlines core principles of safe parking facility design.
- **Part 4** addresses surface parking (parking lots).
- **Part 5** focuses on structured parking (parking garages).

1.3 Background

To develop this guide, the Project Team reviewed Montgomery County crash data, parking lot safety studies from other jurisdictions, best practice parking lot design guidance, and existing county requirements for parking lots. The process was overseen by a group of county agency stakeholders, who met four times over the course of the project. The Project Team also briefed the *Montgomery County Commission on People with Disabilities* on the project and received their feedback to understand safety and accessibility issues for individuals with disabilities.

Good design can enhance the county’s sustainability and make it a better place to live.

1.3.1 Montgomery County and Vision Zero

Vision Zero is a road-safety strategy with the goal of zero fatal and serious injury crashes. A core principle is that the design, construction, and maintenance of the roadway system should minimize the consequences of human error.

Montgomery County adopted Vision Zero in 2016 and committed to eliminating traffic fatalities and serious injuries by 2030 in its Vision Zero 2030 Plan. The county’s Fiscal Year 2024–2025 Vision Zero Work Plan, which is included as an addendum to the plan, notes the number of serious and fatal pedestrian crashes occurring in county parking facilities and specifies that the county will “update parking lot design standards to ensure new or rebuilt lots and garages prioritize and provide parking for people with disabilities, bikes, and micromobility devices,” which is the inspiration for this guide.

1.4 Functions of Parking Facilities

Parking facilities support the County’s economy and quality of life by providing space for people to park cars, trucks, and other vehicles when they are not using them—a critical function in a largely suburban county where many people drive to access destinations and on-street parking is limited. But parking facilities also serve many other functions:

- They are points of transition, where drivers and passengers become pedestrians to reach nearby destinations.
- They function as key links in pedestrian and bicycle networks, often bridging gaps between on-street infrastructure, transit stops, and surrounding land uses.
- They accommodate the loading and unloading of passengers and goods, supporting both daily activities and local commerce.
- They may both serve and include transit services (e.g., bus stops).
- They may serve as flexible space for hosting events and programming such as farmers markets.

1.5 Impact of Parking Facility Design

SAFETY

Parking facilities are places where relatively high volumes of pedestrians, bicyclists, and drivers interact in a confined space. The design of these spaces can profoundly influence the frequency and nature of these interactions, including the potential for fatal and serious injury crashes.

Parking facility repair and maintenance can also have a significant influence on injury risk. For example, potholes or uncleared snow can result in serious pedestrian injuries from slips, trips, and falls, as well as liability for parking facility owners.

Finally, parking facility design can also affect how people perceive their personal safety and the security of their cars, bikes, and personal property.

ACCESS TO DESTINATIONS

If pedestrian and bicyclist access is perceived as unsafe, uncomfortable, or inconvenient, people who might otherwise walk, bike, or use transit to reach a destination may choose to drive instead or not make the trip at all. The former can contribute to traffic congestion and safety concerns on nearby streets. The latter can negatively affect local businesses.

SUSTAINABILITY AND LIVABILITY

Parking facilities account for a substantial portion of the paved, impervious surface in the county. Large, impervious surfaces can result in high runoff volumes, water pollution, and localized flooding and can also contribute to the urban heat island effect, in which urban areas are significantly warmer than nearby rural areas, by absorbing and retaining heat.

Parking facility design can also influence how people perceive their neighborhood serving commercial establishments, including whether communities feel attractive and distinctive or generic and indistinguishable, which can affect local business performance and residents’ sense of belonging.

1.6 Issuing Agency

This guide includes requirements and best practice guidance.

1.6.1 Requirements

The guide summarizes key requirements for parking facilities and provides links to relevant supplemental documents. These requirements must be implemented for all new construction. Failure to comply with requirements could result in enforcement action and could require a variety of remedies by the property owner. Requirements are indicated by the terms “shall,” “must,” and “required”/ “requirement.”

1.6.2 Best Practice Guidance

The guide also illustrates current best practice guidance. Best practice guidance is not explicitly required by the federal government, state of Maryland, or Montgomery County. It should be implemented, except in cases where the Montgomery County Planning Department or other appropriate Montgomery County regulating agency provides a written exemption. Best practice guidance is indicated by the term “should.”



1.7 Required Standards and Guidance Referenced in Guide

The documents in **Table 1** are incorporated into this guide by reference. Parking facility designs must comply with all applicable standards or requirements in these documents.

TABLE 1 Required Guidance Documents and Standards for All Parking Facility Design in Montgomery County

Full Title (Abbr.) and Issuing Agency	Description	Full Title (Abbr.) and Issuing Agency	Description
<u>Americans with Disabilities Act Standards</u> (ADA Standards) <i>U.S. Department of Transportation, U.S. Department of Justice</i>	▪ Establishes minimum standards for facilities covered by the Americans with Disabilities Act of 1990. ▪ Applies to new construction and alterations on undeveloped or redeveloped land and alterations to existing facilities.	<u>NFPA 1 Fire Code</u> <i>National Fire Protection Association</i>	▪ Requires parking facilities to include fire access roads.
<u>Architectural Barriers Act Accessibility Standards</u> (ABA Standards) <i>United States Access Board</i>	▪ Establishes minimum accessibility standards for facilities designed, built, or leased with federal funds. ▪ Applies to new construction and alterations.	<u>Montgomery County Code, Chapter 22, Fire Safety Code</u> <i>Montgomery County</i>	▪ Specifies building setback and height thresholds, minimum width and distance from buildings, and required turn-around space for fire access roads and lanes.
<u>Maryland Accessibility Code</u> (MAC) <i>Maryland Building Codes Administration</i>	▪ Establishes minimum accessibility requirements for buildings and facilities, including requirements for accessible parking.	<u>Montgomery County Executive Regulation 14-24</u> <i>Montgomery County</i>	▪ Amends previous language in the county code to reflect the wording now used by the National Fire Protection Association.
<u>Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way</u> (PROWAG) <i>United States Access Board (Access Board)</i>	▪ Establishes minimum standards for permanent and temporary facilities in the public right-of-way. ▪ Applies to new construction on undeveloped or redeveloped land and alterations to existing facilities.	<u>Complete streets policy and standards, Sec. 49.25</u> <i>Montgomery County</i>	▪ Requires that road planning, design, construction, and reconstruction accommodate all users (pedestrians, bicyclists, transit riders, and motorists) and directs the county to adopt formal Complete Streets design standards through regulation.
<u>Maryland Manual on Uniform Traffic Control Devices for Streets and Highways</u> (Md MUTCD) <i>Maryland State Highway Administration (SHA)</i>	▪ Establishes standards and guidelines for traffic control devices, including signs, signals, and pavement markings. ▪ Updated within two years after a new edition of the Federal Highway Administration’s MUTCD is issued. ▪ Most recent federal MUTCD adopted in January 2024; hence, new Md MUTCD edition is expected soon.	<u>Roadway Standards and Guidelines</u> <i>Montgomery County Department of Transportation</i>	▪ Covers the design of commercial driveways, including sight distance. ▪ Includes the standard detail (MC-302.01) for commercial driveways.
<u>Montgomery County Code, Chapter 59, Montgomery County Zoning Ordinance</u> (Zoning Ordinance) <i>Montgomery County</i>	▪ Establishes requirements for parking lot location, multimodal access, circulation, layout, landscaping, and outdoor lighting. ▪ Establishes minimum and maximum parking space requirements.	<u>Streetlighting Design Requirements, Installation Procedures, and Specifications</u> <i>Montgomery County Department of Transportation</i>	▪ Provides requirements for street lighting in the public right-of-way.
		<u>Landscape Design Guidelines</u> <i>Montgomery County Department of Permitting Services</i>	▪ Establishes planting requirements for stormwater facilities.

Table 2 provides a list of other key guidance documents referenced in this guide. The guidance in these documents should be implemented, except in cases where the Montgomery County Planning Department or other appropriate Montgomery County regulating agency provides a written exemption.

TABLE 2 Required Guidance Document (Absent Written Exemption)

Full Title (Abbr.) and Issuing Agency	Description	Full Title (Abbr.) and Issuing Agency	Description
<u>Fire Department Access Performance-Based Design Guide</u> <i>Montgomery County Department of Permitting Services</i>	▪ Describes performance-based design alternatives that aim to meet prescriptive fire department access requirements while allowing for other needs, including pedestrian and bicycle safety.	<u>AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (AASHTO Ped Guide)</u> <i>American Association of State Highway and Transportation Officials</i>	▪ Emphasizes that parking facility layout strongly affects pedestrian mobility and safety. ▪ Recommends that parking facilities include designated pedestrian routes, safe driveway crossings, and lighting, rather than expecting pedestrians to use informal spaces like drive aisles.
<u>Montgomery County Accessible Design Guide</u> <i>Montgomery County Department of Transportation</i>	▪ Provides guidance for designing accessible pedestrian facilities in the public right-of-way.	<u>AASHTO Guide for the Development of Bikeways (AASHTO Bike Guide)</u> <i>American Association of State Highway and Transportation Officials</i>	▪ Provides guidance on the design of bike lanes and shared use paths, including designing transitions from one facility type to another. ▪ Provides guidance on the design of short- and long-term bicycle parking.
<u>Montgomery County Complete Streets Design Guide</u> <i>Montgomery Planning, Montgomery County Department of Transportation</i>	▪ Establishes policies and design standards for “Complete Streets” that prioritize safety, sustainability, and multimodal access.		
<u>Montgomery County Curbless & Shared Streets Design Guide</u> <i>Montgomery Planning, Montgomery County Department of Transportation</i>	▪ Provides design principles, standards, and examples for creating curbless and shared streets in Montgomery County, focusing on safety, accessibility, and flexibility for all users.		
<u>Montgomery County Pedestrian Master Plan</u> <i>Montgomery Planning</i>	▪ Recommends policy, design, infrastructure, and programming changes to make pedestrian travel safe, comfortable, convenient, and accessible for pedestrians of all ages and abilities.		
<u>Montgomery County Bicycle Master Plan, Appendix K</u> <i>Montgomery Planning</i>	▪ Appendix K includes guidelines for bicycle parking.		
<u>Pedestrian and Bicyclist Safety in Parking Facilities</u> <i>Institute of Transportation Engineers</i>	▪ Summarizes pedestrian and bicyclist safety issues in parking lots. ▪ Provides design guidance for design parking facilities for safe pedestrian and bicycle access.		

2

Key Parking Facility Traffic Safety and Accessibility Issues

This section summarizes parking facility safety and accessibility issues identified through an analysis of Montgomery County parking facility crash data from January 1, 2015, to May 31, 2025, input from Montgomery County stakeholders, including a project steering committee and the Montgomery County Commission on People with Disabilities, and a review of traffic safety literature.

2.1 Key Safety Issues

- **Parking facilities are places with frequent conflict points between motorists and pedestrians and bicyclists, who are at substantially greater risk of injury in the event of a crash.** In Montgomery County, nearly two-thirds of fatal and serious injury parking facility crashes involved pedestrians, including all six fatalities between January 1, 2015, and May 31, 2025. An additional 3% of fatal and serious injury crashes involved bicyclists. While only 0.3% of motorist-only parking facility crashes in Montgomery County resulted in serious injuries, the share rises to 4% for bicyclist-involved crashes and 7% for pedestrian-involved crashes, amounting to an elevated risk of serious injury for pedestrians and bicyclists that is 13 and 23 times higher than it is for motorists, respectively. Consequently, designs that fail to adequately accommodate the safety needs of pedestrians and bicyclists are more likely to contribute to fatal and serious injury outcomes.
- **High car speeds and quick accelerations increase the risk.** As car speeds increase, so do both the likelihood of a crash and the severity of injuries when crashes occur (**Figure 1**). Although car speeds in parking facilities are typically lower than on streets and highways, parking lots often function as shared spaces where motorists, pedestrians, bicyclists, and other users mix. In such environments, even modest increases in speed can substantially elevate the risk of serious injury, particularly for older adults.
- **High car volumes increase the risk.** Higher car volumes increase the number of potential crashes at locations where drivers share space with pedestrians or bicyclists, such as in drive aisles or where pedestrians must cross a building frontage road (Turner et al. 2006).
- **The lack of separated walkways and bicycle facilities and poorly designed shared spaces and crossings increase the likelihood of pedestrian and bicyclist-involved crashes.** Without clearly defined and separated travel areas, pedestrians and cyclists are exposed to motor vehicle traffic in environments where right-of-way expectations are often unclear. Where shared spaces are not intentionally designed to communicate their multimodal function, drivers may perceive them as primarily intended for vehicular travel, leading to driver behaviors that increase conflict potential and crash risk for more vulnerable users.
- **Poor visibility is a cause of crashes.** Poor visibility between drivers, pedestrians, and bicyclists increases the likelihood of a pedestrian or bicyclist-involved crash by decreasing the chances that drivers will notice the pedestrian or bicyclist and react in time to avoid the crash. Visibility appears to be a key factor in backing crashes, where a vehicle moving in reverse strikes another vehicle, pedestrian, bicyclist, or object. Such crashes made up 23% of all parking facility crashes in Montgomery County. It also presents a significant challenge at parking facility entrances and exits, especially for structured parking, where pillars or walls may conceal crossing pedestrians and bicyclists.
- **Drivers making left turns pose a greater danger to pedestrians.** Left turns pose a significantly greater risk to pedestrians in parking facilities than right turns. A study of New Jersey parking lots conducted for the Institute of Transportation Engineers’ (ITE’s) Pedestrian and Bicyclist Safety in Parking Lots guide (Kueper et al. 2017) found that among cars turning into aisles, 21 pedestrian crashes involved left turns but only one crash involved a right turn. On building frontage roads, 38 pedestrian crashes involved left turns and only two involved right turns. Overall, of 76 pedestrian crashes involving turning cars, 71 (94%) were associated with left turns, while only five (6%) involved right turns. This increased risk is largely due to driver behavior and visibility. Left-turning drivers must look across opposing traffic and often focus on finding a gap, which can divert their attention away from pedestrians. In contrast, right turns are typically shorter, slower, and involve less complex decision-making, making it easier for drivers to see and yield to pedestrians.

- **Some facilities have inadequate wayfinding information.** Without adequate wayfinding in parking facilities, pedestrians, bicyclists, and drivers are unsure where to go. They struggle to locate exits, pedestrian routes, bicycle parking, or their own parked vehicle. This uncertainty increases vehicle circulation and leads to unpredictable driver behavior. It causes pedestrians and bicyclists to take indirect routes through areas where they face a higher risk of crashes.
- **Some facilities have pedestrian fall hazards.** Uneven surfaces, abrupt changes in level, and lack of snow and ice clearance can result in pedestrian falls that cause serious or fatal injuries that are not recorded in crash data. A nationwide study by Rundle et al. (2024) found that pedestrian falls on streets and sidewalks classified as “emergent” or “critical” in Emergency Medical Services data occurred at a rate 2.3 times higher than those resulting from pedestrian–motor vehicle crashes. This figure was nearly double for individuals 50 years or older (injurious falls 4.3 times greater) and almost triple for individuals 65 and older (injurious falls 6.5 times greater).

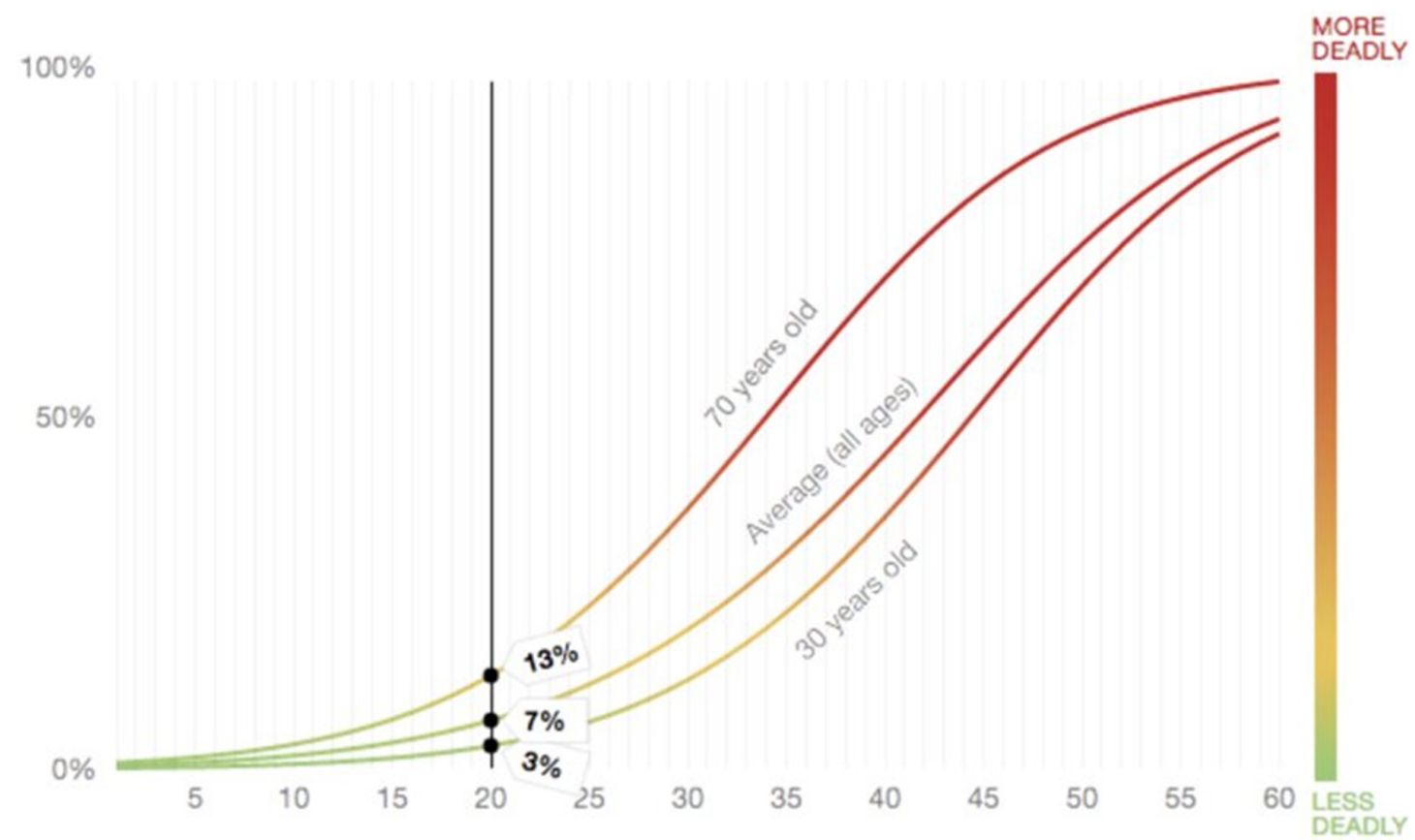


FIGURE 1 Risk of death by age and motor vehicle speed based on data from the National Highway Traffic Safety Administration’s 2001 Pedestrian Crash Data Study, which included both crashes in the public right-of-way and on private property, including in parking lots. (Source: ProPublica)

2.2 Key Accessibility Issues

- ~~There is a lack of standard accessible and van-accessible parking spaces.~~ Members of the Montgomery County Commission on People with Disabilities (Disability Commission) reported that there are often no standard or van-accessible spaces available where people with disabilities can park. In this situation, people who need accessible spaces may park across multiple spaces, park in access aisles, or use non-designated spaces (University of Kansas Research & Training Center on Community Living). They may also choose to leave and return later or skip the trip entirely.
- **Access aisles adjacent to accessible parking spaces are sometimes obstructed.** According to Disability Commission members, even when accessible spaces are provided, the adjacent access aisle is sometimes obstructed by a parked car, shopping carts, snow, or other objects, potentially making it impossible for a person with a disability to deploy a ramp or use an accessible route between their vehicle and their destination.
- **Standard (non-accessible) parking spaces are often too narrow for the larger cars many people drive today.** Some people with disabilities may be able to use standard (non-accessible) parking spaces, such as individuals who use a cane or walker. However, Disability Commission members reported that these spaces are often too narrow for them to exit their vehicles and safely maneuver between adjacent cars.
- **Separated walkways are not provided.** Disability Commission members identified the lack of separated walkways as a top concern. People with disabilities may be more vulnerable to fatal or serious injury crashes due to factors such as reduced ability to evade a backing vehicle or challenges with wayfinding related to vision or cognitive disabilities. Separated walkways reduce conflicts with cars, bicycles, and other vehicles while clarifying wayfinding.
- **Curb cuts are often blocked.** Disability Commission members reported that curb cuts with accessible ramps providing access to walkways are sometimes unavailable or blocked by vehicles, such as delivery trucks. When this happens, a person with a disability may not have a safe and convenient route to their destination.
- **There is sometimes inadequate wayfinding to locate accessible routes.** According to Disability Commission members, even where accessible routes are provided, people with disabilities sometimes have difficulty identifying or navigating them due to insufficient wayfinding features, such as directional signage, signage identifying accessible entrances, and other design elements—such as separated walkways—that clearly indicate accessible paths.
- **Snow can cover accessible parking spaces and accessible routes.** Disability Commission members reported that snow is sometimes stored in accessible parking spaces or accessible routes, making them unusable by people with disabilities.



3 Principles of Safe Parking Facility Design

This section describes the principles that informed design recommendations outlined in sections Four and Five, Surface Lots and Structured Parking Lots. Designers apply these principles when creating new parking facilities.

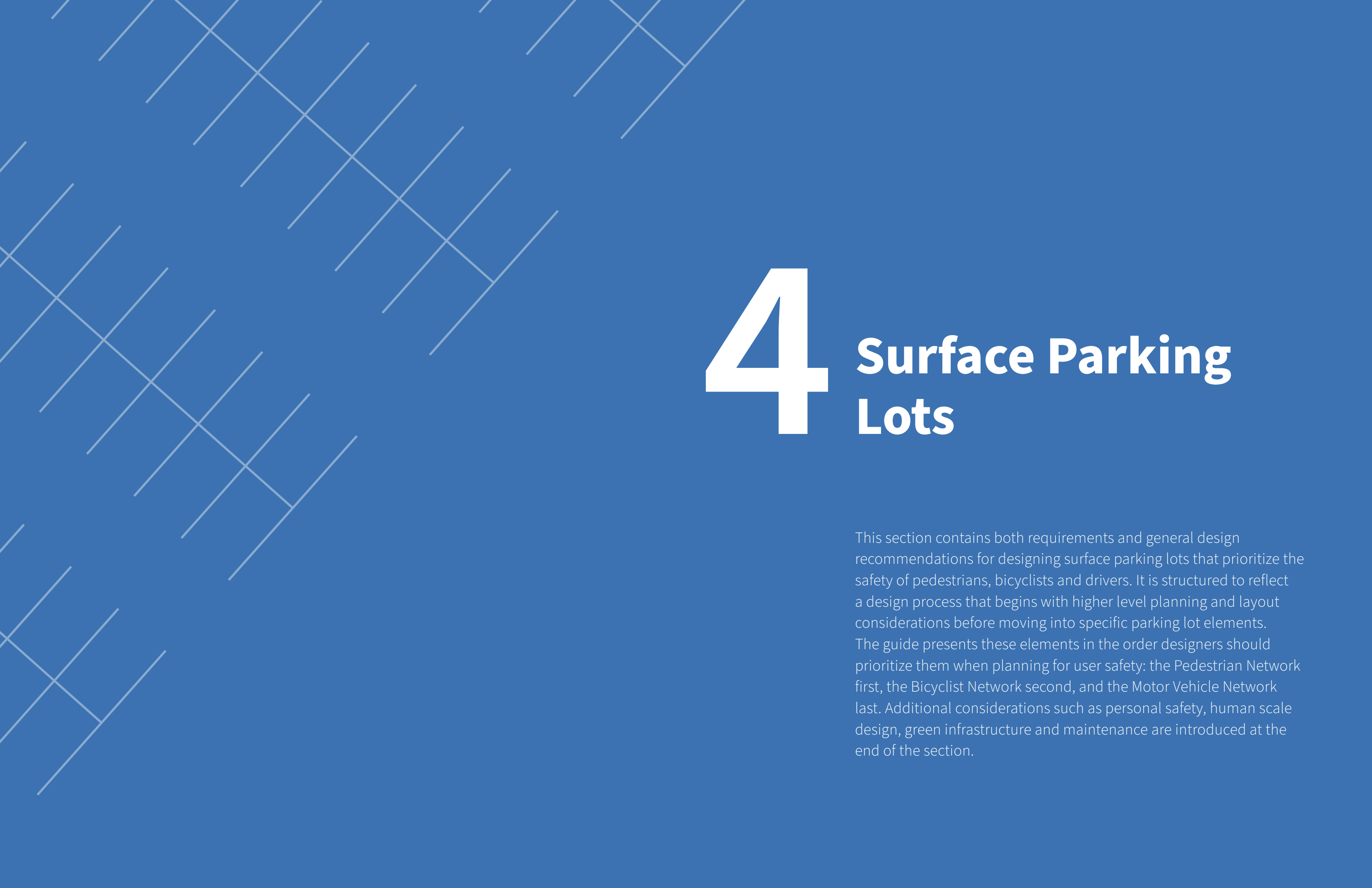
- **Start with a Safe System approach.** Incorporate Safe System principles and elements into the design process from the beginning (**Figure 2**). For example, design parking facilities with the understanding that “humans make mistakes” and “humans are vulnerable” and incorporate appropriate design responses, such as designing motor vehicle circulation routes to produce low motor vehicle speeds and separating modes where possible.
- **Recognize that parking facilities are multi-use spaces.** Design them to provide safe access for all users and uses—not just motor vehicle parking.
- **Prioritize pedestrian and bicyclist access.** Parking facilities are usually optimized for vehicle storage and circulation first, with everything else squeezed into leftover space. Prioritizing pedestrian and bicycle access at the beginning of the design process makes it easier to create predictable, legible, and convenient routes that pedestrians and bicyclists will follow. It also makes it possible to reduce conflict points and make the site function better overall. In addition, putting pedestrian and bicyclist access first supports the County’s [Climate Action Plan](#), which includes a goal of reducing greenhouse gas emissions by shifting trips away from cars.
- **Create a connected network of walkways and bikeways that allow people to safely navigate parking facilities.** The network should follow desire lines as closely as possible and link parking stalls to entrances, sidewalks, transit stops, and adjacent destinations.
- **Reduce motor vehicle speeds**, especially where drivers and pedestrians are likely to mix, such as drive aisles and building frontage roads.
- **Reduce motor vehicle volumes**, especially in areas with high pedestrian activity such as building frontage roads, by designing circulation routes that encourage drivers to bypass these locations.
- **Minimize the conflict points between cars and pedestrians and bicyclists.** Where such conflicts are unavoidable, minimize pedestrian and bicyclist exposure (e.g., by reducing crossing distances).
- **Maximize visibility and conspicuity among users. Provide unobstructed sightlines and clear cues.** The design of ~~other~~ parking facility elements, such

as parking stalls, parking aisles, and intersections, should provide clear sightlines between all parking facility users.

- **Design shared spaces to convey that they are used by people walking, bicycling, and driving** and encourage very low motor vehicle speeds.
- **Provide clear, intuitive wayfinding** through consistent signage, pavement markings, and logical route design so that pedestrians, bicyclists, and drivers can easily understand where to go. This reduces unnecessary circulation, minimizes exposure to high-risk areas, and encourages more predictable, safer movements for all users.
- **Design for vulnerable people.** Prioritize the needs of older adults, people with disabilities, and children, recognizing their heightened injury risk and accessibility needs.



FIGURE 2 The Safe System Approach (Source: FHWA)



4

Surface Parking Lots

This section contains both requirements and general design recommendations for designing surface parking lots that prioritize the safety of pedestrians, bicyclists and drivers. It is structured to reflect a design process that begins with higher level planning and layout considerations before moving into specific parking lot elements. The guide presents these elements in the order designers should prioritize them when planning for user safety: the Pedestrian Network first, the Bicyclist Network second, and the Motor Vehicle Network last. Additional considerations such as personal safety, human scale design, green infrastructure and maintenance are introduced at the end of the section.

4.1 Planning Considerations

4.1.1 Land-Use Context

When designing surface parking lots, it is essential to consider the land uses they will serve. Land use shapes who is likely to use the site, how they are likely to access it, and the needs they are likely to have once they arrive. These user needs should inform the design of individual parking lot elements (e.g., walkways that enable visitors to push strollers or shopping carts). Examples of design considerations by the type of land use are provided in **Table 3**.

TABLE 3 Example Design Considerations by Land-Use Context

Land Use	Design Consideration
Retail	Consider the impact of shopping carts, frequent delivery activity, higher pedestrian volume, and multiple access points.
Institutional uses	Expect increased presence of children, older adults, or people with disabilities, as well as larger shared vehicles, such as buses and vans.
Transit-oriented uses	Expect high pedestrian volumes traveling to and from transit and ride-share services; prioritize pedestrian connections to transit stops.
Restaurants	Expect frequent delivery activity and drop offs; locate loading away from main pedestrian entrances.

Surface lot design should also consider whether the facility serves multiple destinations, as pedestrians will need to maneuver within the parking lot and across building frontage roads to access cars, carts, and multiple venues.

If land use changes, adjusting surface lot elements to reflect new user needs is preferable, where feasible.

4.1.2 Future Development

Surface parking lots should be designed to accommodate both future on-site development and development of adjacent parcels. This allows surface lots to be more responsive to changing land uses and urban development needs.

- Where future on-site development is anticipated, space and align internal circulation routes to function as future streets or development blocks. For larger sites, the recommended spacing between internal circulation routes is 300 – 350 feet (**Figure 3**), which reflects the desirable spacing range for pedestrian friendly street blocks.
- If future development on adjacent sites is anticipated, plan how pedestrian and bicycle networks will connect across parcels as they build out. This is an especially important pedestrian consideration, as pedestrians may avoid walking on sidewalks or pathways if the route is inconvenient. Where parcels are under different ownership, public accessibility across connections should still be maintained. Inter-parcel connectivity can be supported through access easements established during the entitlement process.

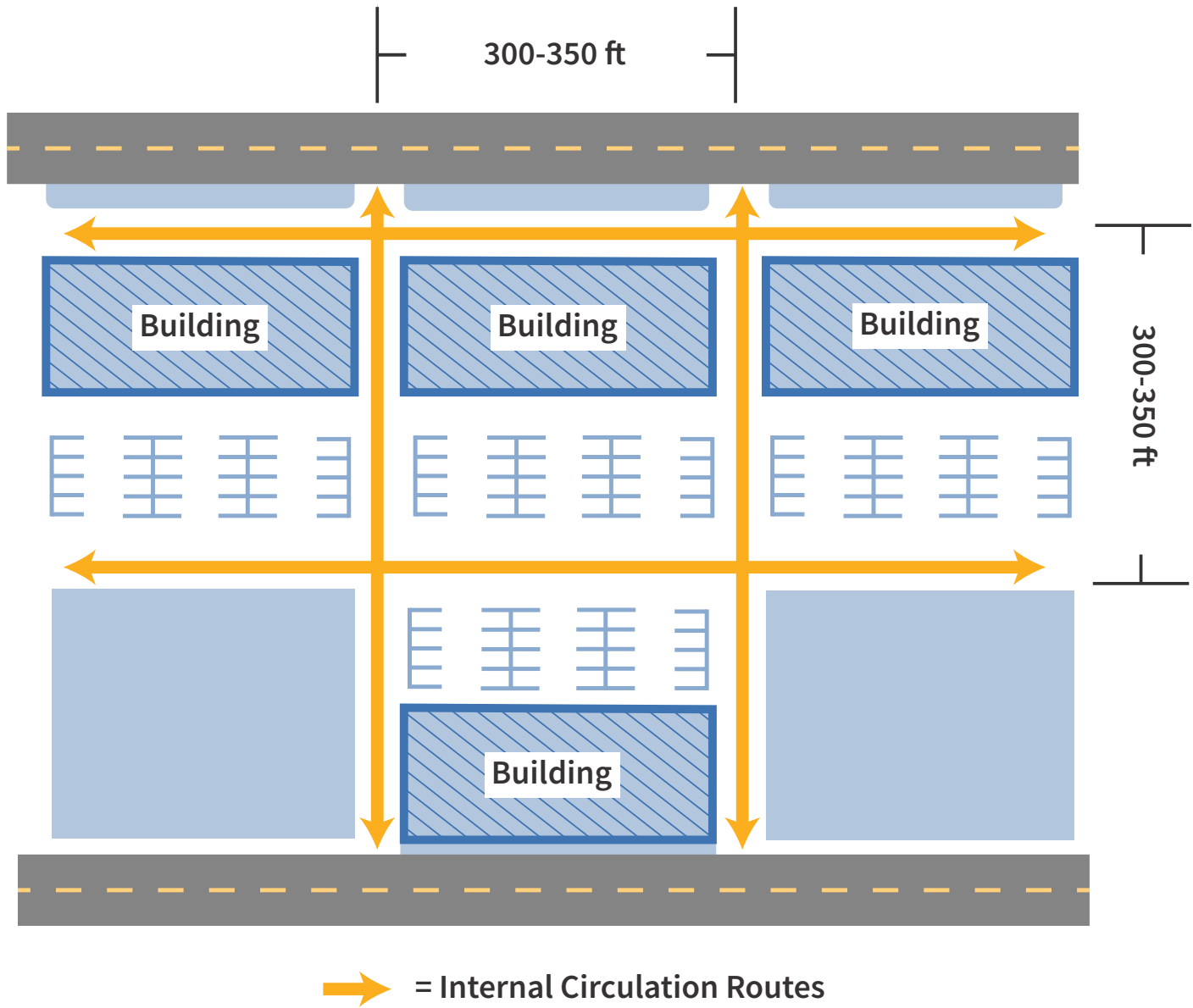


FIGURE 3 Recommended spacing between internal circulation routes

4.2 Layout

Layout refers to how the different components of a parking lot are arranged and integrated to maximize safety and overall functionality. There are many different components within a parking lot; however, this section focuses only on general, high-level considerations of how these components fit together, with more specific guidance reserved for the individual sections addressing each element.

TABLE 5 Minimum Required Accessible Parking Spaces Specified in [ADA Standards 208](#)

Total Number of Parking Spaces Provided in Parking Facility	Minimum Number of Required Accessible Parking Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1,000	2% of total
1,001 and over	20, plus 1 for each 100, or fraction thereof, over 1,000

4.2.1 Layout Requirements

TABLE 4 Key Layout Requirements

Design Element	Criteria	Reference
Walkways	• Must include pedestrian walkways or sidewalks as needed for pedestrian safety.	Montgomery County Zoning Ordinance Section 59.6.2.5.I – Walkways
Accessible routes	• Accessible routes complying with ADA Standards Chapter 4: Accessible Routes are required between parking spaces and accessible building entrances.	ADA Standards 206, Accessible Routes
Driveway access	• Max. two driveways permitted for every 300 feet of site frontage. • If a property has on-site parking accessible via a sufficiently wide improved alley (min. 20 feet), then access to that parking must come from the alley, and new curb cuts along the public street should be minimized. • Unless it is on a residential road, a corner lot (with one driveway) or a through-lot must be accessed from the low-er-classified street.	Montgomery County Code, Article 59-6, Section 6.1.4. Driveway Access
Access for fire apparatus	• Fire apparatus access includes approved load-bearing, all-weather surfaces, including public, private, or access roads, driveways, parking lots, shoulder, and buffers, whose use is required to access more than one residential dwelling unit or any non-residential occupied building. • Fire apparatus access required when a building is set back more than 150 feet from a public road or exceeds 30 feet in height and is set back more than 50 feet. • Additional roads/lanes may be required if congestion, terrain, or other factors could impair a single route.	Montgomery County Code §22-32 Required access for fire apparatus NFPA 1 §18.2.3.3
Accessible parking spaces	• Minimum spaces as specified in Table 5, with additional spaces required for hospital outpatient and rehabilitation facilities. • One van-accessible space required for every six (or fraction of six) required accessible parking spaces. • Accessible parking spaces must be located on the shortest accessible route to an accessible entrance.	ADA Standards 208, Parking Spaces¹
Motorcycle/scooter parking spaces	• Facilities with more than 50 parking spaces must provide motorcycle or scooter parking equal to at least 2% of vehicle spaces, up to 10 spaces.	Montgomery County Zoning Ordinance Article 59.6, Section 6.2.3
Car-share spaces	• Facilities with 50–149 spaces must have at least one car-share space, plus one additional space per 100 spaces above 149, up to a maximum of five; additional car-share spaces beyond the minimum are permitted.	Montgomery County Zoning Ordinance Article 59.6, Section 6.2.3
Electric vehicle spaces	• Facilities with 100+ spaces built after May 12, 2014, must include at least one EV-ready space per 100 spaces, or frac-tion thereof.	Montgomery County Zoning Ordinance Article 59.6, Section 6.2.3
Bicycle parking spaces	• By land use as specified in Table 6.2.4C of the Montgomery County Zoning ordinance.	Montgomery County Zoning Ordinance Article 59.6, Section 6.2.3
Standard parking spaces	• By land use as specified in Table 6.2.4B of the Montgomery County Zoning ordinance. • Minimum requirements may be reduced if a facility is near a high-frequency transit line; in a parking lot district or reduced parking lot area; for specified special uses; for shared parking; for provision of car-share or carpool/vanpool spaces; for provision of bikeshare, etc.	Montgomery County Zoning Ordinance Article 59.6, Section 6.2.3
Off-street loading spaces	• Required for multi-unit living, commercial/retail, and industrial land uses.	Montgomery County Zoning Ordinance Article 59.6, Section 6.2.8. Loading Design Standards

¹ [Montgomery County Zoning Ordinance Article 59.6, Section 6.2.3.B.](#) defers to state requirements, which are contained in [COMAR 09.12.53](#), and state requirements defer to the ADA Standards

4.2.2 Layout Guidance

Parking lot layout is the foundation of safe surface parking lot design. The way a parking lot is laid out has direct impacts on the number of conflict points between pedestrians, bicyclists, and cars, as well as on the overall internal circulation within the lot. When selecting a layout, designers should aim to reduce conflicts and to provide networks for all travel modes—walking, bicycling, and driving—that offer clear, direct, and safe routes through the site.

Locate buildings at the street edge and place parking lots to the back or side of buildings.

Layout considerations begin with building setbacks and the placement of the parking lot relative to the building. Designers should locate parking lots behind or to the side of buildings, with the building positioned at the street edge. Minimizing the setback between the building and the street creates direct street access for people walking, biking, or rolling to the building, and reduces conflict points by allowing people who arrive by non-vehicular means to reach their destination without traversing the surface parking lot.

Locating buildings at the street edge also improves the pedestrian experience and quality of the site. Buildings that directly front the street create a sense of enclosure, activate the sidewalk, and contribute to a more walkable, human-scale environment. By contrast, parking lots placed between the building and the street prioritize car access over pedestrian comfort, create wide expanses of pavement at the street edge, and diminish the sense of place for people arriving on foot or by bicycle (Figure 4).

Incorporate pedestrian and bicyclist networks from the beginning of the design process.

Not every site can accommodate buildings at the street edge with parking located to the back or side. However, the principle behind this preferred layout, that the pedestrian and bicyclist experience should be prioritized and considered from the beginning of the design process, applies to all lots.

Designers should consider how people of all travel modes will travel through the parking lot and the broader site to reach their destinations, expanding both their understanding of travel modes to be considered and destinations to plan for. This means accounting for how people travel from their cars to building entrances, how pedestrians and bicyclists move between entrances and nearby sidewalks, shared-use paths, bicycle lanes, and transit stops, and how users may continue through the lot to access destinations on adjacent sites.

Design bicycle networks around building entrances and bicycle parking locations.

Parking lot bicycle networks should provide safe and convenient connections to adjacent streets, existing bike-ways, and on-site bicycle parking. Bicycle parking should be located close to building or destination entrances and bicycle access routes should follow circulation roads rather than drive aisles, where the risk of bicycle–vehicle conflicts is higher (Figure 5). ~~Where feasible, designated bikeways, such as separated bike lanes or shared-use paths, are preferred.~~

Further information on the individual components of bicycle networks can be found in the section on Bicycle Network Elements.



FIGURE 4 Parking lot located at the back of a building



FIGURE 5 Bicycle parking near building entrances

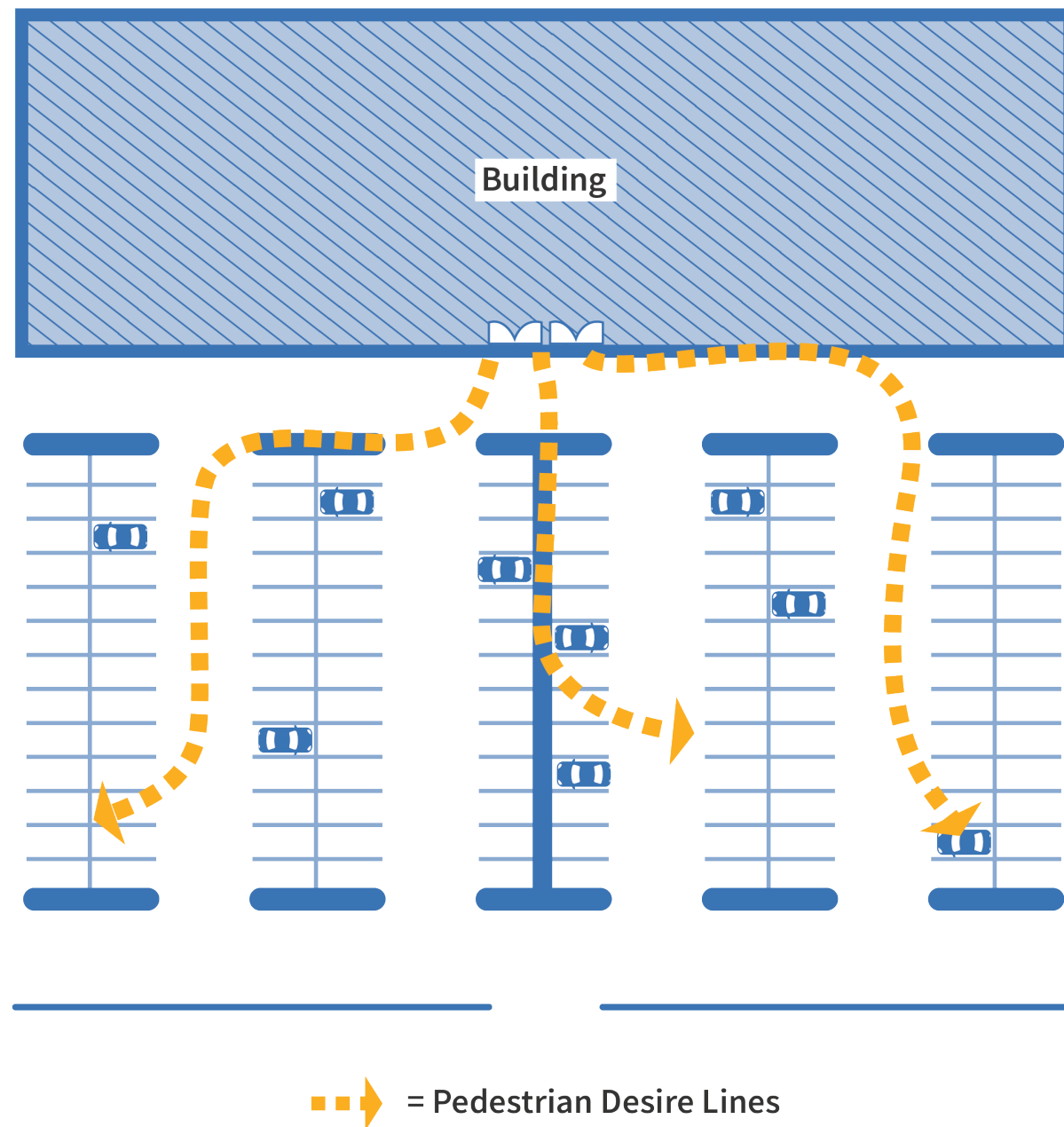


FIGURE 6 Pedestrian desire lines

Layout parking lots so that pedestrian networks follow pedestrian desire lines.

Design parking lots so pedestrian routes align as closely as possible with pedestrian desire lines. Anticipate these desire lines by considering both directness, i.e., the shortest path to key destinations, and comfort, including features such as shade. Networks that require significant detours are less likely to be used as intended, with research indicating that pedestrians have a particularly low tolerance for indirect routes in parking lots. Compliance with designated routes improves substantially when those routes reflect natural desire lines (Alhajaj 2023) (**Figure 6**). Pedestrian networks should be clearly defined along designated paths that ideally offer separation from circulating cars and that are supported by appropriate pedestrian infrastructure. Further information on the individual components of pedestrian networks can be found in the section on 4.3 Pedestrian Network Elements.

Design motor vehicle networks to reduce car volumes on the building frontage road (BFR).

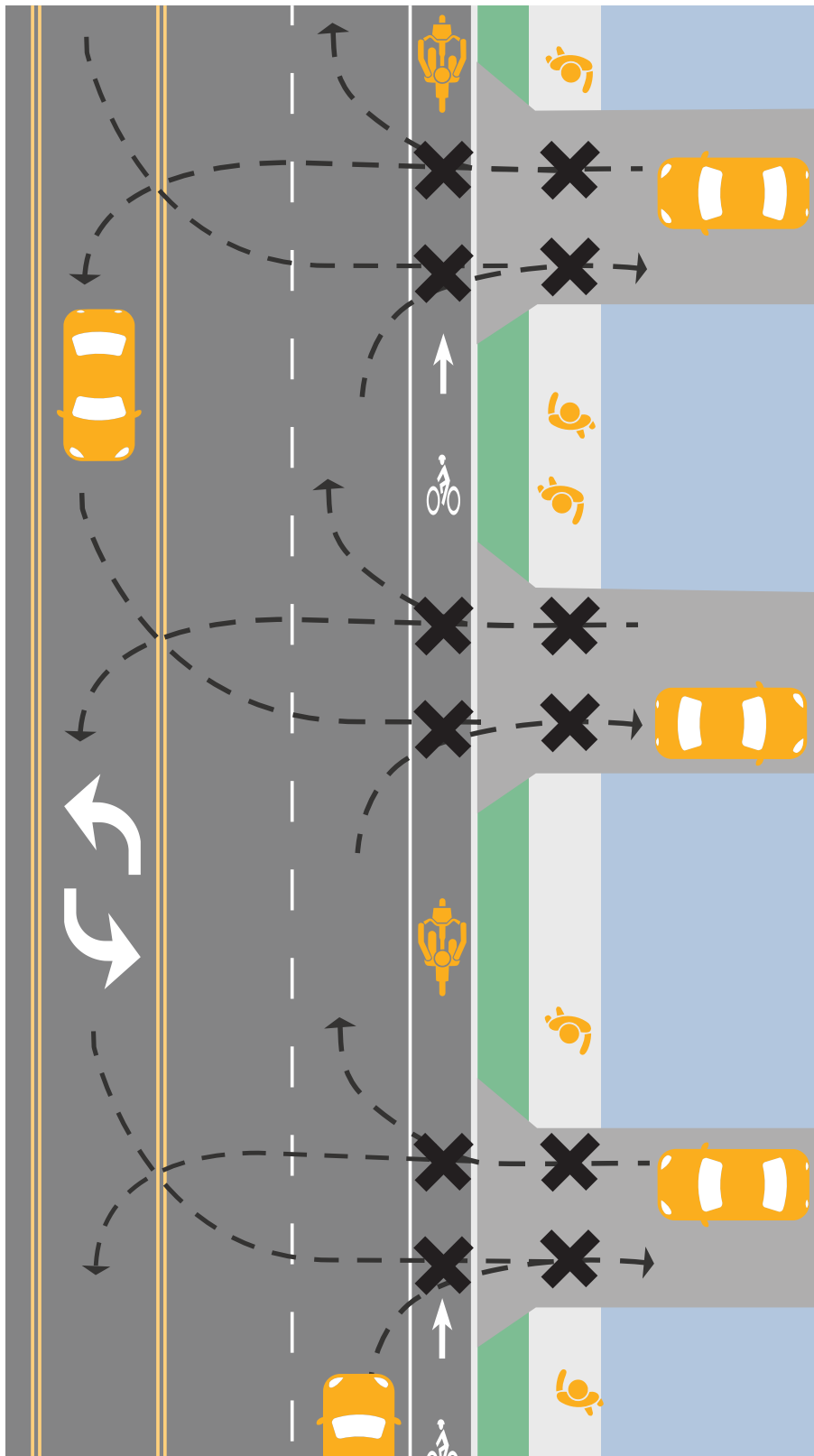
The primary objective when designing vehicular circulation routes should be to reduce car volumes in areas of high pedestrian activity. Reducing the volume of cars circulating along the BFR is particularly critical, as this is where pedestrian activity is highest within parking lots. Higher BFR volumes occur when drivers search for parking by accessing driving aisles directly from the BFR rather than using circulation or ring roads located farther from the building. Parking lot layouts should be designed to make alternative circulation routes more convenient than traveling along the building edge, directing through-traffic away from pedestrian-dense areas. The following strategies are recommended:

- **Intermediate Circulation Roads:** In large lots, a circulation road should be provided that runs parallel to the BFR at a spacing of 300–350 feet, with connections to both entrances and exits. This gives drivers a convenient alternative route to access parking aisles without relying on the BFR (**Figure 7**). Intermediate circulation roads should be spaced and aligned to support long-term flexibility, as described in the layout section, they can function as streets in the event of future redevelopment.
- **Ring Roads:** Where feasible, a continuous ring road should be designed to allow drivers to access aisles and circulation roads without passing along the building frontage. Ring roads pull through traffic away from pedestrian-dense areas near the building entrance and reduce the number of cars circulating on the BFR.
- **BFR Termination:** Terminating the BFR reduces its convenience for through-movements, keeping it primarily as a drop-off and direct building access area where vehicle volumes and speeds are lower.

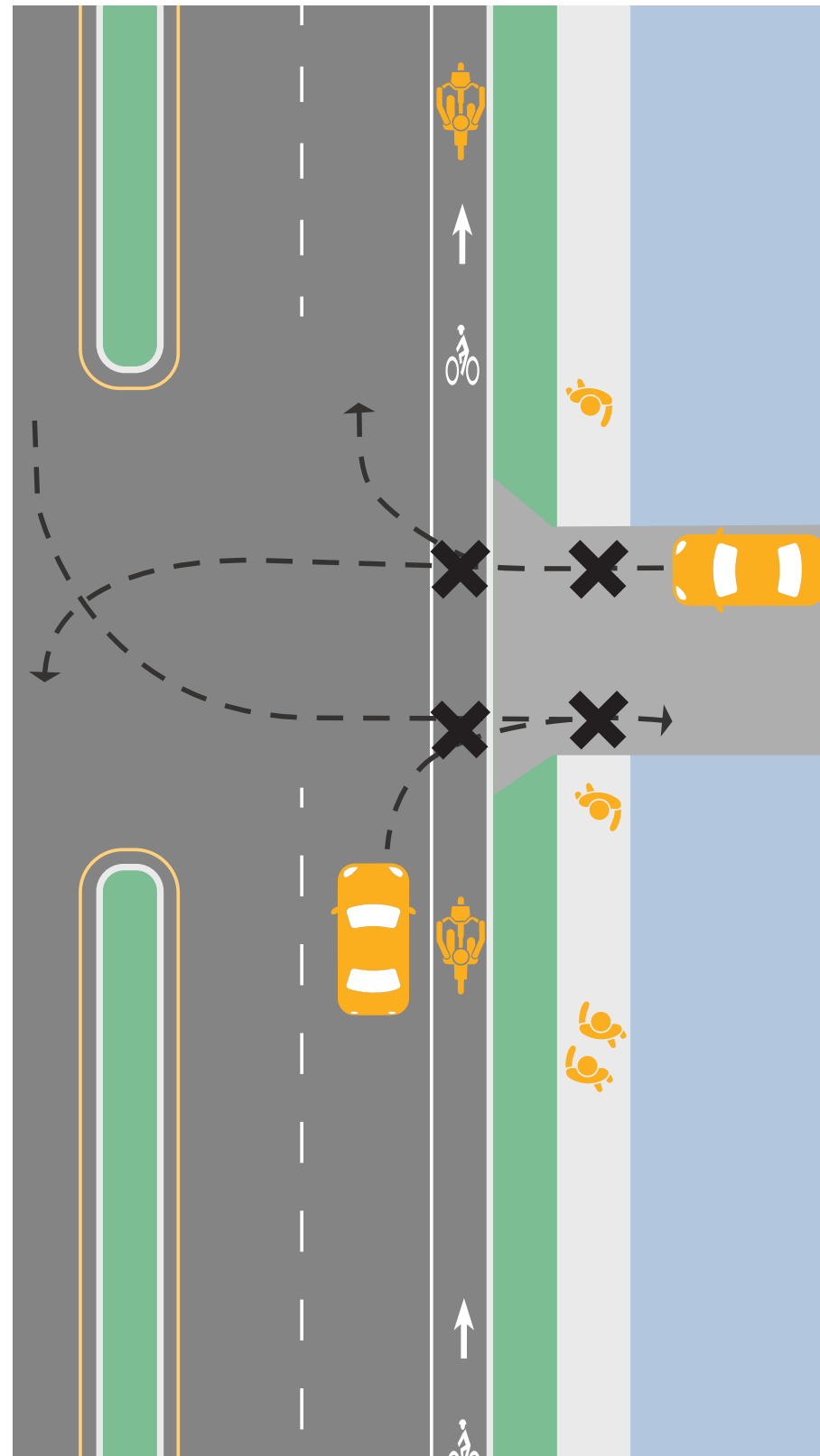


FIGURE 7 Building frontage road (BFR) terminated with bollards

Before



After



Avoid locating parking stalls on the far side of ring roads.

Parking stalls should be located inside ring roads, so that pedestrians walking between their cars and buildings are not required to cross a ring road. Ring roads are designed to carry higher vehicle volumes and speeds than aisles and building frontage roads, exposing pedestrians to unnecessary ring road crossings significantly increases their crash risk. By locating stalls inside ring roads, pedestrian movements are contained within the lower-speed interior of the lot, reducing the number of crossings of high-volume travel ways.

Minimize the number of driveways.

For both pedestrian and bicycle networks, thoughtful layout is critical to minimizing conflict points. One key strategy is reducing the number of driveway crossings, through access point consolidation, as each driveway introduces a potential conflict with turning cars. (Figure 8). Ensuring that the motor vehicle network within the lot extends between parcels is one method of consolidation, as it allows a single driveway to serve multiple destinations. Additional guidance on improving safety at driveway crossings is provided in Section 0, 4.14. Driveways.

For additional guidance on the design of ring roads, including traffic calming and crossing treatments, see Section 4.15. Ring and Circulation Roads.

Minimize the number of parking spaces.

Designers should minimize the number of parking spaces while still meeting county requirements. Smaller parking areas can shorten pedestrian and bicyclist travel paths, reduce the number of conflict points between pedestrians and circulating cars, and limit the scale of internal car circulation, which can encourage lower motor vehicle speeds. In addition to these benefits, right-sizing parking also supports broader land-use goals by improving site aesthetics and reducing impervious surface area, which in turn lessens stormwater runoff and environmental impacts.

Existing county requirements for parking spaces are shown in **Key Pedestrian Access Route Requirements for Parking Lot Areas in the Public Right-of-Way** and **Table 5** and include provisions for reduced parking where appropriate, such as in areas with transit access or opportunities for shared parking.

FIGURE 8 Driveway consolidation: before and after

4.3 Pedestrian Network Elements

Parking lot pedestrian networks include accessible routes, walkways, crosswalks, curb ramps, and informal shared spaces often used by pedestrians, such as drive aisles and unmarked crossing locations (Figure 9).

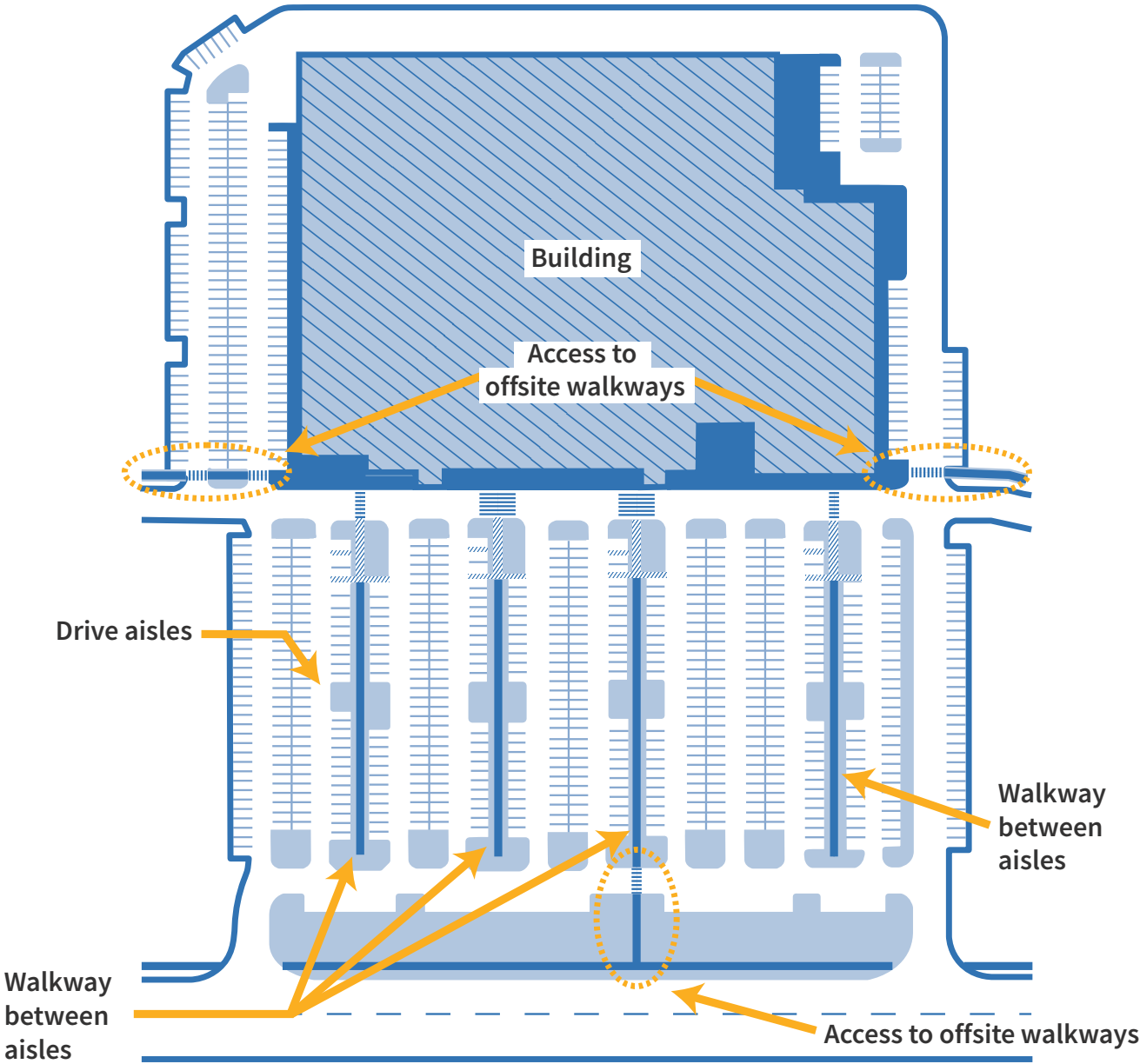


FIGURE 9 Pedestrian network elements

4.3.1 Accessible Routes

Accessible routes are continuous, unobstructed paths that provide an accessible connection between building entrances and accessible parking spaces. They allow people of all abilities to safely navigate through a surface lot to their intended destination. A route must meet strict requirements to be deemed accessible.

4.3.1.1 Accessible Route Requirements

Requirements for accessible routes are provided in **Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way** and **Table 7**. The requirements in **Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way** come from the ADA Standards and apply to parts of a parking lot design that are outside of the public right-of-way, while the requirements in **Table 7** come from PROWAG and apply to parts of a parking lot design that are within it. These standards are slightly different. For example, the ADA Standards allow clear width to be as narrow as 32” at pinch points; however, the minimum clear width in PROWAG is 48”.

TABLE 6 Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way

Design Element	Criteria	Reference
Clear width	At non-turn locations: • Min 36” • Can narrow to 32” at pinch points for max 24” length. At turns: • Min 42” min approaching, 48” at the turn	ADA Standards, 403 Walking Surfaces
Passing spaces	• Required if clear width is less than 60” • Min 60” by 60” every 200’ max	ADA Standards, 403 Walking Surfaces
Slope	• Running slope max 1:20 • Cross slope max 1:48	ADA Standards, 403 Walking Surfaces
Surface	• Stable, firm, slip resistant • Openings must not allow passage of a sphere more than ½ inch. • Place elongated openings so long dimension is perpendicular to the dominant direction of pedestrian travel.	ADA Standards, 302 Floor and Ground Surfaces
Changes in level	• 0” to ¼” vertical edge permitted • > ¼” to ½” bevel required with max slope of 1:2 • > ½” comply with ADA Standards, 405 Ramps or 406, Curb Ramps.	ADA Standards, 303 Changes in Level

TABLE 7 Key Pedestrian Access Route Requirements for Parking Lot Areas in the Public Right-of-Way

Design Element	Criteria	Reference
Clear width—All locations except medians/refuges and shared use paths	•Min 48” exclusive of curb	PROWAG 302.2
Clear width—medians and refuge islands	•Min 60”	PROWAG 302.2
Clear width—shared use paths	•Full width provided for pedestrian circulation	PROWAG 302.2
Passing spaces	•Required if clear width is less than 60” •Min 60” by 60” every 200’ max	PROWAG R302.3
Grade	•≤ 5% or the grade of the adjacent street, whichever is greater •May exceed 5% in crosswalk if superelevation requires grade greater than 5%	PROWAG R302.4
Cross slope	•Max 2.1%	PROWAG 302.5
Surface	•Firm, stable, slip-resistant	PROWAG R302.6
Horizontal openings	•Must not allow a sphere larger in diameter than ½” to pass through	PROWAG R302.6.3
Grade breaks	•Must be flush	PROWAG R302.6.2
Changes in level	•0” to ¼” vertical edge permitted •> ¼” to ½” bevel required with max slope of 50% •> ½” to 6” max slope 8.3% •> 6” must comply with PROWAG R407.	PROWAG R302.6.2
Protrusion limits	•Max 4” for objects with leading edges 27” to 80” above walking surface	PROWAG R402.2
Objects mounted on single post or pylon	•Max 4” measured horizontally from the post or pylon or measured horizontally from the outside edge of the base where the base height is min 2 ½” •Applies to objects mounted 27” to 80” above walking surface	PROWAG R402.2
Objects mounted between posts or pylons	•Where clear distance between posts is greater than 12”, the lowest edge must be max 27” or min 80”	PROWAG R402.3.2
Vertical clearance	•Min 80”	PROWAG R402.4

4.3.2 Accessible Route Guidance

Meeting accessible route requirements as stated in the ADA and PROWAG is essential, but designing these routes thoughtfully increases their overall effectiveness and comfort. Designers should think carefully about the layout of access routes and their interactions with the vehicular network. For example, while the location of accessible parking spaces is dictated by the location of building entrances and the shortest accessible route, it is up to the designer to consider how to reduce pedestrian and vehicle conflicts along the accessible route, and how to improve safety and user comfort at these points of conflict. It is also up to the designer to ensure that regular vehicle circulation and movement throughout the lot (e.g. informal loading zones blocking crosswalks or vehicle overhang encroaching on pathways) does not impede access (**Figure 10**).



FIGURE 10 Example of accessible parking located on the shortest possible route to front entrance

Provide wayfinding.

Accessible routes within parking lots should be direct, continuous, intuitive, and clearly differentiated from vehicular areas (e.g., with a contrasting surface color). Whenever possible, these routes should take the form of physically separated walkways, with high-visibility, ladder-style crosswalks marking pedestrian crossings. Signage with the International Symbol of Accessibility and directional arrows, as needed, should be installed to clarify the location of accessible entrances, accessible parking spaces, and locations where accessible paths may diverge from primary pedestrian routes (**Figure 11**).



FIGURE 11 Wayfinding to accessible entrance

Consider Vehicle Overhang.

The minimum clear width required in the ADA Standards, 403 Walking Surfaces, summarized in **Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way**, must be maintained on accessible routes. Due to the nature of parking lot layouts, vehicles are often parked directly adjacent to pedestrian facilities, and failure to account for vehicle overhang can result in clear widths that are less than the required minimum. Vehicle overhang can be mitigated in multiple ways, including:

- Providing pedestrian facilities that are wider than the specified minimum clear width to account for vehicle overhang.
- Using bollards, wheel stops or other vertical separation barriers where parking stalls abut the sidewalk to ensure adequate separation. Bollards are the preferred method of separation as their vertical height provides consistent separation regardless of individual vehicle specification (e.g. a truck with a substantial rear overhang or tow attachment encroaching on ~~side walk~~, even with the presence of wheel stops.)
- Providing a landscaped setback between accessible routes and parking spaces.

Although vehicle overhang is dependent on vehicle model, a minimum two foot overhang should be assumed when designing mitigation strategies, with greater separation preferred.

4.3.3 Walkways and Sidewalks

Walkways and sidewalks are the pedestrian network elements that are ~~designated exclusively for pedestrian and bicyclist travel~~, unlike drive aisles and crossings, which experience vehicular traffic. Consequently, they ~~designate~~ the safest areas for pedestrians to travel through. Due to their safety benefits, these pedestrian network elements are required, as outlined in the Montgomery County Zoning Ordinance Section 59.6.2.5.1 – Walkways, with additional requirements outlined in **Table 7**.

4.3.3.1 Walkway and Sidewalk Requirements

TABLE 8 Key Walkway and Sidewalk Requirements

Design Element	Criteria	Reference
Walkways or sidewalks on accessible routes	Must comply with ADA Standards Chapter 3: Building Blocks and ADA Standards Chapter 4: Accessible Routes, which are summarized in Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way .	<u>ADA Standard 206, Accessible Routes</u>
Walkways or sidewalks in the public right-of-way	Must comply with PROWAG R302 and R402, which are summarized in Table 7 .	<u>PROWAG R302</u> <u>PROWAG R402</u>
Distinguishing features	Must be distinguished by stripes, curbs, or other methods approved by the applicable deciding body.	<u>Montgomery County Zoning Ordinance Section 59.6.2.5.1 – Walkways</u>

4.3.3.2 Walkway and Sidewalk Guidance

Prioritize making walkways and sidewalks accessible.

Designers should strive to make all walkways, sidewalks, crosswalks, and other pedestrian network elements within parking lots accessible. This approach ensures that designated pedestrian facilities, often the safest areas for pedestrians to travel within a parking lot, are accessible to everyone, including individuals with temporary disabilities who may not qualify for accessible parking spaces. This approach also allows for accessible access when parking lots are used for programing such farmers markets. Additional information on designing accessible routes can be found in **Section 4.5.2 Accessible Routes**.

For walkways that are not on designated accessible routes and where existing terrain makes it infeasible to meet ADA running slope requirements, designers should aim to meet PROWAG guidance, which permits the running slope to match that of the adjacent roadway.

Provide centerwalks to physically separate pedestrians from parked and circulating cars.

Centerwalks are designated pedestrian paths between parking aisles that connect to building entrances, reducing pedestrian exposure to both circulating cars and backing maneuvers. Designers should strive to provide at least one centerwalk in all lots, with the safety need of this element increasing with the size of the lot and expected pedestrian volumes. Centerwalks are especially vital in lots where parking aisles are oriented parallel to the primary building frontage, as seen in **Figure 12**.

When centerwalks are in parking lots with drive aisles that are perpendicular to the building frontage road the design of the centerwalk should account for vehicle overhang, as parked cars that are stationed too closely to the centerwalk may partially obstruct the walkway. Mitigation strategies include the use of wheel stops and designing wider centerwalks, as seen in **Figure 14**.

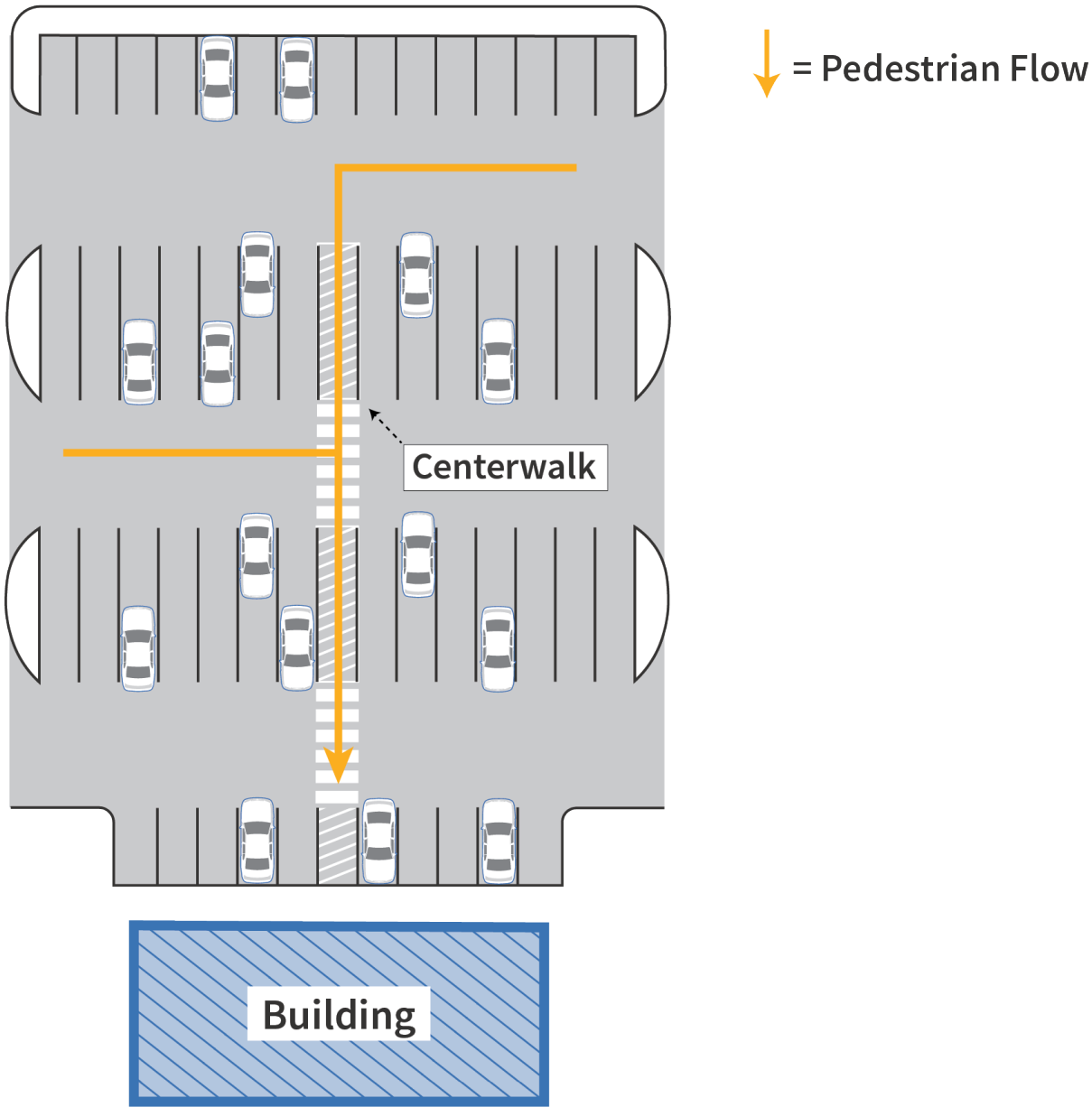


FIGURE 12 Aisles parallel to building frontage and centerwalk

Consider alignment and placement of centerwalks.

Centerwalks should be aligned as closely as possible with pedestrian desire lines and connect directly to parking stalls and key building entrances. Typically, this results in centerwalks that are located down the center of the parking lot, although in larger lots there may be additional centerwalks located on either end of the lot as seen in **Figure 13**.

Use landscaping strategically

Landscaping can be incorporated into centerwalks to create shade and encourage pedestrians to travel along the centerwalk instead of through drive aisles. Landscaping along the edges of centerwalks should be strategically designed to allow frequent access to the centerwalk from adjacent parking stalls. Designers should lean towards narrower landscaped setbacks, as setbacks that are excessively wide may make it more difficult for pedestrians to access the centerwalk. See **Figure 13**.

Follow treatment hierarchy.

Centerwalks should provide physical separation from cars wherever possible. The following treatments are listed in order of preference:

- **At sidewalk level:** sidewalk level centerwalks provide vertical separation from cars, enhance pedestrian visibility and clearly communicate that the route is designated for pedestrians. It is the most effective treatment and should be used wherever feasible. See **Figure 14**.
- **Bollard-protected at-grade:** preferred where a sidewalk-level centerwalk is not feasible; in locations with heavy shopping cart use, bollards are particularly appropriate as they allow carts to pass while still providing pedestrian protection. Wheel stops should not be used to provide physical separation, as they present tripping hazards. See **Figure 15**.
- **Pavement markings only:** least preferable, as they provide no physical separation between pedestrians and cars. See **Figure 16**.

Where centerwalks are at road level, designers should incorporate visual elements that communicate to both drivers and pedestrians that it is a designated pedestrian route. This can be accomplished through wayfinding or additional elements such as colored or textured pavement.



FIGURE 13 A wide landscaped setback makes it difficult for pedestrians to access the centerwalk to and from parking spaces



FIGURE 14 Sidewalk-level centerwalk



FIGURE 15 Street-level centerwalk protected by wheelstops



FIGURE 16 Centerwalk designated by pavement markings

Provide building frontage sidewalks that comfortably accommodate expected uses.

Building frontage sidewalks are located directly adjacent to building faces along frontage roads. They support a range of activities beyond pedestrian travel that, depending on land use, may include loading, micromobility parking, benches, café seating, merchandise displays, sandwich boards, and shopping cart storage. Building frontage sidewalks are also places where people may stop for window shopping, conversing, checking phones, waiting for rides, and other purposes. Accounting for landscaping, enhancing the comfort and aesthetics of the facility, should be considered when planning for these uses.

Building frontage sidewalks must comfortably accommodate and organize this activity while preserving the unobstructed accessible clear width that is needed for pedestrian through-movement. They should be organized into three functional zones: a Frontage Zone, a Clear Zone, and a Street Buffer Zone, as described in the Montgomery County Complete Streets Design Guide.

Frontage Zone

The Frontage Zone is the portion of the building frontage sidewalk located between the front of a building and the Clear Zone. It includes building façades and store or building entrances, and may also include other features, such as retail displays, café seating, and shopping cart storage. The width of this zone depends on the combination of objects and activities expected to occupy the space but should be a minimum of two feet wide to account for pedestrian “shy distance,” the space pedestrians instinctively maintain between themselves and vertical objects like building facades, retail displays and other people.

Clear Zone

The Clear Zone is the portion of the building frontage sidewalk located between the Street Buffer Zone and the Frontage Zone that is reserved exclusively for accessible pedestrian through-movement. This zone must comply with ADA requirements for accessible routes (see [Key Accessible Route Requirements for Parking Lot Areas Not in the Public Right-of-Way](#)) and remain free of vertical elements, obstructions, and temporary obstacles. It should be continuous, predictable, and easy to navigate, accommodating expected pedestrian volumes and supporting users of all abilities, including those with vision, intellectual, and developmental disabilities. The Clear Zone should be a minimum of six feet wide—sufficient for two people to comfortably pass in opposite directions—with wider dimensions preferred where feasible. It should also be visually distinct from adjacent zones (e.g., using contrasting color), to reinforce its purpose as an unobstructed path of travel and to aid wayfinding for pedestrians with disabilities.

Street Buffer Zone

The Street Buffer Zone is the portion of the building frontage sidewalk between the Clear Zone and the building frontage road. It separates pedestrians in the Clear Zone from moving motor vehicle traffic and provides space for passenger boarding and alighting, loading and unloading goods (e.g., from delivery trucks), and amenities such as benches, landscaping, bicycle and micromobility parking, trash bins, and lighting. The width of this zone depends on the combination of objects and activities expected to occupy the space but should be a minimum of four feet wide, with six feet preferred to accommodate for street trees.

Total Building Frontage Sidewalk Width

Combined, these zones result in a recommended minimum sidewalk width of 14 feet. In constrained conditions with lower pedestrian volumes, a minimum width of eight feet may be acceptable, as seen in **Figure 17**.



FIGURE 17 Street zones diagram (Source: ~~MoCo CS Design Guide~~)

4.3.4 Crosswalks

Crosswalks designate the conflicts points between the pedestrian and vehicular circulation routes. Depending on the parking lot configuration, a surface lot can include many crosswalks, or a few concentrated on the building frontage road (BFR).

4.3.4.1 Crosswalk Requirements

TABLE 9 Key Crosswalk Requirements

Design Element	Criteria	Reference
Crosswalks on accessible routes	Must comply with ADA Standards Chapter 4: Accessible Routes .	ADA Standards 206, Accessible Routes

4.3.4.2 Crosswalk Guidance

Crosswalks should be provided at all pedestrian crossing locations on ring and circulation roads to clearly communicate to both drivers and pedestrians that they are at a designated conflict point.

At BFR's, designers should first develop an understanding of pedestrian desire lines before selecting crosswalk locations. Where pedestrian desire lines are easily discernable and distinctly spaced, due to fewer building entrances, crosswalks should be located at every building entrance and centerwalk location. Where numerous building entrances create closely spaced desire lines, marking every crossing would cover much of the BFR and diminish the visual impact of individual crosswalks. In this situation, designers should instead use distinctive surface treatments, such as colored or textured pavement. Drawing on the visual language of shared spaces and curbless streets, these treatments signal to drivers that frequent pedestrian crossings should be expected throughout the BFR. Textured pavements should be supplemented with high visibility crosswalk marking at centerwalk locations and major destinations, such as the entrance to a grocery store.

Designers should use high-visibility markings styles such as ladder or continental style markings, instead of crosswalks markings consisting of two transverse lines, see **Figure 18**. These marking styles are more visible, improving both driver awareness of pedestrian crossing locations and driver yielding behavior (MUTCD, 2023).



FIGURE 18 High-visibility continental style crosswalk

4.3.5 Curb Ramps

4.3.5.1 Curb Ramp Requirements

TABLE 10 Key Curb Ramp Requirements

Design Element	Criteria	Reference
Curb ramps on accessible routes	Must comply with ADA Standards 406.	ADA Standards 206, Accessible Routes
Curb ramps in the public right-of-way	Must comply with PROWAG R304.	PROWAG R203.6

4.3.5.2 Curb Ramp Guidance

Perpendicular, directional curb ramps should be installed throughout the site, as preferred by Montgomery County (**Figure 19**). While diagonal curb ramps and blended transitions may meet ADA requirements, directional ramps are preferred as they directionally align users, particularly those with vision disabilities, with the crosswalk and reduce the need for wheelchair users to reorient themselves within the roadway.

In addition, accessible curb ramps or blended transitions should be provided consistently on both sides of each crosswalk, where sidewalk is provided. Providing an accessible treatment on only one side can create confusion for people with vision disabilities and others navigating the crossing.

4.3.6 Drive Aisles as part of the Pedestrian Network

Drive aisles are routinely used by pedestrians to travel through surface parking lots and should be considered part of the pedestrian network, as seen in **Figure 20**. They provide a less desirable pedestrian route, as they do not provide separation between pedestrians and circulating cars. Designers should strive to provide dedicated pedestrian facilities such as sidewalks and centerwalks and provide incentives for pedestrians to use them, as outlined in **Section 4.6 Walkways and Centerwalks**.

People with disabilities or temporary mobility limitations may depend on drive aisles for their travel, especially if accessible parking spaces are unavailable. Given that pedestrians of all abilities routinely use these spaces, designers should design them to meet the requirements in PROWAG 302, which include requirements for surface, changes in level, and horizontal openings. Additional considerations for the design of drive aisles can be found in ~~Section 4.17 Drive Aisles~~.



FIGURE 19 Directional curb ramp at a crossing



FIGURE 20 A person walking in the drive aisle

4.4 Bicycle Network Elements

Parking lot bicycle network elements include spaces where bicyclist and cars are expected to share the road, for example on the BFR, or separated facilities such as centerwalks or frontage sidewalk (Figure 21). In some cases, they may also include dedicated bikeways.

4.4.1 Shared Spaces

4.4.1.1 Shared Space Guidance

When buildings are not located at the street edge, the BFR typically serves as the primary circulation route for bicyclists, connecting site entrances to building entrances. As such, it represents the most likely travel path through the lot for bicyclists and experiences substantial pedestrian activity as people cross between parked cars and building entrances. Given the high volume of intersecting modes and the frequency of conflict points along the BFR, designers should incorporate shared space and curbless street design principles. These designs prioritizes low vehicle speeds and use pavement treatments, raised crossings, and other interventions to communicate bicyclist priority and alert drivers to the presence of multiple modes. For detailed guidance on designing BFRs using shared space principles see Section 4.6.3.2 BFR Guidance, specifically the discussions of reinforcing target speed through geometry, traffic calming, and signage.

4.4.2 Bikeways

The term “bikeway” applies to any path or travel way that is designated for bicycle travel. These facilities may be exclusive to bicycles or be shared with other travel modes. While formal bikeways are uncommon within parking lots, as bicyclists are often expected to mix with car traffic, bicycle circulation planning should be included in the surface lot design process to ensure the availability of clear and safe routes for bicycle travel.

4.4.2.1 Bikeways Guidance

Appropriate bicycle accommodation varies by parking lot element:

- **Building Frontage Roads:** BFRs should function as low-speed shared-use environments where bicyclists and cars are expected to share the roadway. Design speeds and roadway geometry should reinforce this shared condition.
- **Drive Aisle:** Bicycle circulation paths through drive aisles should be avoided. Drive aisles, with their high vehicle traffic and frequent backing-out movements, elevate the risk of car–bicyclist crashes. Bicyclists should be routed to their destination through circulation roads or the BFR. If this presents an undesirable (i.e., circuitous) bicycle travel path, then facilities such as centerwalks, which allow bicyclists to ride through the parking lot with physical separation from parking cars, should be considered. In these circumstances, centerwalks should be configured as a shared-use path with a minimum 10-foot clear width.
- **Circulation/Ring Roads:** These roads, which may have operating speeds greater than 20 mph, should comply with relevant guidance in the Montgomery County Complete Streets Design Guide for Town Center Streets (See CSDG, p. 56) and should be considered for bike lanes or separated bikeways, as recommended in the AASHTO Guide for the Development of Bikeways.

4.4.2.2 Facility Transitions

Transitions between different types of bikeways, such as from a separated bikeway along a circulation road to a shared BFR, should be designed in accordance with the AASHTO Guide for the Development of Bikeways.

4.4.2.3 Conflict Markings

Clear markings or signage should be used to denote locations where bicyclist and motor vehicle paths cross (e.g., where bike lane crosses a driveway opening).



FIGURE 21 Bike marking in parking lot

4.5 Bicycle and Micromobility Parking

4.5.1 Bicycle and Micromobility Parking Requirements

For bicycle and micromobility parking requirements, see [Montgomery County Zoning Code Section 59.6.2.6](#), [Montgomery County Zoning Text Amendment No. 19-8](#), and the [Montgomery County Bicycle Parking Guidelines](#).

4.5.2 Bicycle and Micromobility Parking Guidance

Bicycle parking should be located near building entrances and positioned to provide direct, convenient access without requiring bicyclists to travel through drive aisles or to cross building frontage roads after parking their bikes. On large sites serving multiple destinations, bicycle parking should be distributed across the site to serve each key destination directly, rather than being concentrated in a single location.

In addition, bicycle parking should accommodate non-traditional bicycle types, including adult tricycles, cargo bikes, and adaptive cycles. These bicycles are often larger and not compatible with standard racks, so designers should ensure that a portion of parking spaces can accommodate them. The appropriate proportion will vary by land use. For example, an elementary school may require a higher share of spaces for non-traditional bicycles, as caregivers may use cargo bikes, trailers, or trail-a-bikes to transport children. (**Figure 22**).



FIGURE 22 Bicycle parking that accommodates different bike types

4.6 Motor Vehicle Network Elements

4.6.1 Driveways

Driveways are a critical element in parking lot design, functioning as the principal interface between parking facilities and public roadways. Safety-minded design here is centered on managing the multiple conflict points between entering and exiting cars, through-traffic on the public roadway, and pedestrians or bicyclists traveling along the roadway.

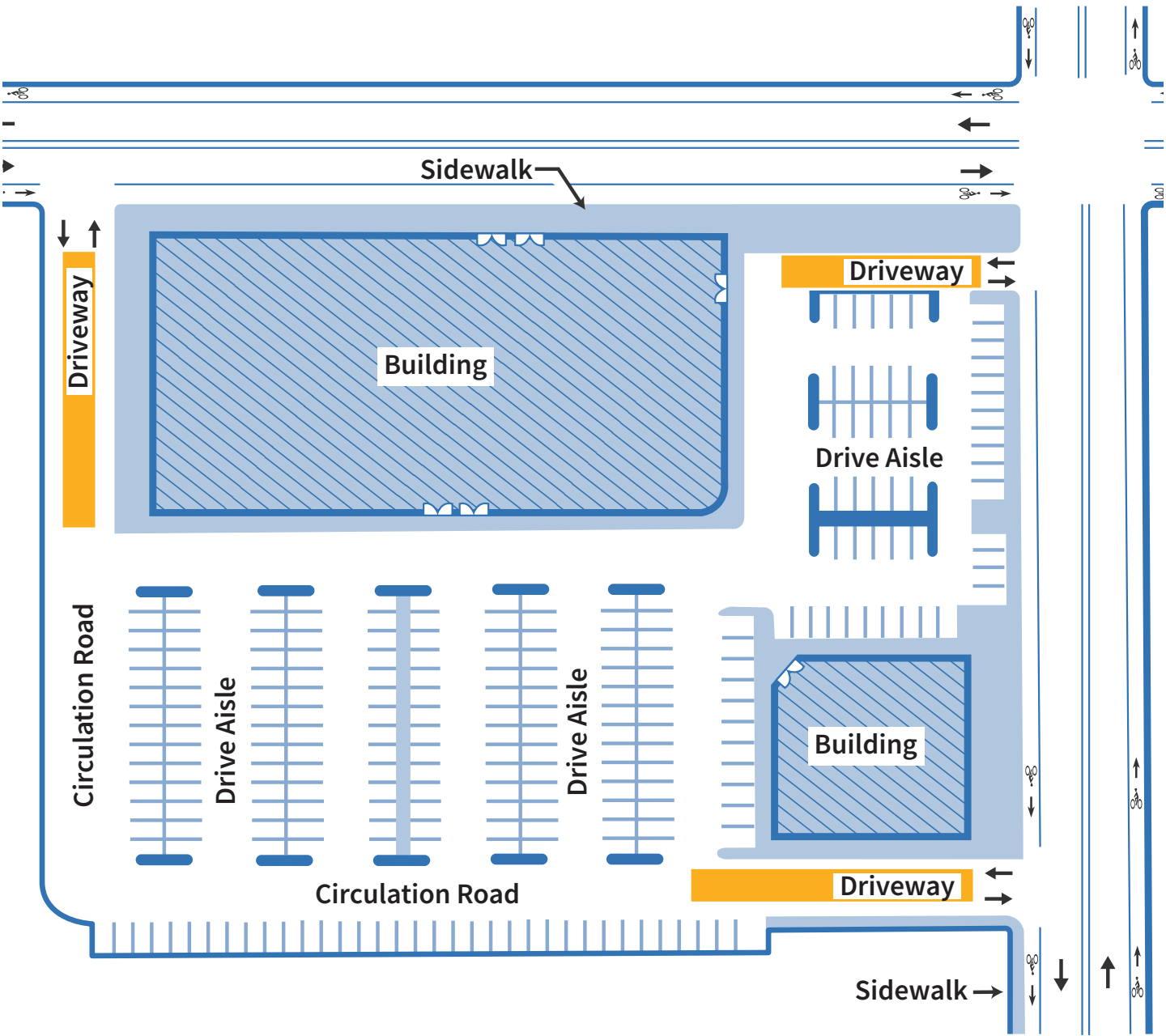


FIGURE 23 Illustrative circulation diagram depicting driveway locations

4.6.1.1 Driveway Requirements

TABLE 11 Key Driveway Requirements

Design Element	Criteria	Reference
Driveway dimensions	Must comply with minimums in Montgomery County Code, Article 59-6, Section 6.1.4 Driveway Access , reproduced below as Table 12 .	Montgomery County Code, Article 59-6, Section 6.1.4. Driveway Access
Distance between driveway and first stalls	For access from state roads, must comply with minimums in Table 2.4.4 of the MDOT SHA Access Manual , reproduced below as Table 13 . For access from county roads, 100 feet recommended.	MDOT SHA Access Manual, Chapter 2, §2.4.4
Material	Must be constructed of asphalt or concrete from the edge of roadway pavement to the property and must be in conformity with other driveways in the neighborhood.	Montgomery County Driveway Construction Policy

TABLE 12 Required Minimum Driveway Dimensions by Land-Use Type and Travel Direction²

Zone ³	Configuration	Width (min)	Width (max)	Radius (max)
R-30, R-20, R-10	One-way	12'	16'	10'
R-30, R-20, R-10	Two-way	20'	24'	10'
CR, CRT, CRN, EOF, LSC, GR, NR	One-way	12'	18'	10'
CR, CRT, CRN, EOF, LSC, GR, NR	Two-way	20'	32'	15'
IL, IM, IH	One or two-way	30'	40'	30'

TABLE 13 Minimum Throat Length for Commercial/Industrial Entrances from State Roads⁴

Type of Development	Min. Throat Length
Regional shopping mall	250'
Community shopping center (supermarket, drugstore, other stores)	120'
Small strip shopping center	30'
Regional office park	250'
Office building/professional center	80'
Small commercial development sites	30'

² From [Montgomery County Code, Article 59-6, Section 6.1.4. Driveway Access](#).
³ See [Montgomery County Zoning Code, Section 2.1.2, Zoning Categories](#) for definitions of listed categories.
⁴ from [MDOT SHA Access Manual](#)

4.6.1.2 Driveway Guidance

Enhance pedestrian and bicyclist visibility.

Pedestrian and bicyclist visibility at driveways is essential, particularly along busy roadways where drivers may turn quickly without anticipating crossing pedestrians or bicyclists. Visibility can be enhanced through continuous sidewalks and pavement markings. Specific requirements for designing pedestrian facilities can be found in 4.3 Pedestrian Network Elements.

Design sidewalks to be continuous across the driveway.

The most effective way of increasing the visibility of pedestrians crossing driveways is to design sidewalks to be a continuous level across driveway entrances. As seen in Figure 24, this design results in a sidewalk that extends across the driveway at sidewalk grade rather than ramping down to road level. This design produces lower motor vehicle speeds by requiring drivers to ramp up when crossing the sidewalk and makes pedestrians more visible by raising them up within a driver’s field of vision.

Improve pedestrian and bicyclist visibility through pavement markings.

At sidewalk grade crossings, crosswalk markings are generally not needed. However, on high-vehicle volume driveways (i.e., more than 500 cars per day) where the pedestrians cross at roadway level, ladder-style high visibility crosswalk markings are recommended. Research has shown that high visibility crosswalks result in higher levels of driver yielding and compliance than standard parallel markings, making them the preferred option at driveway crossings (O’Brien et al. 2022).

Where bikeways cross driveways, whether at sidewalk or roadway grade, bicycle conflict markings, as shown in Figure 25, should be applied to highlight bicyclist priority and improve visibility.

Reduce car turning speeds by using narrow driveways and tight radii.

High vehicle turning speeds at driveways increase crash risk and reduce the likelihood that drivers will yield to crossing pedestrians and bicyclists. To encourage slower turning speeds, designers should prefer the minimum driveway width required in Table 12 and incorporate tight motor vehicle turning radii.

Smaller turning radii require drivers to turn more slowly and deliberately, improving their ability to see and yield to pedestrians and bicyclists crossing the driveway. Turning radii should be 20 feet or tighter.

Where expected truck turning movements prevent the use of tight turning radii, designers should use truck turning aprons to accommodate larger cars. Turning aprons, seen below in Figure 26, allow larger cars to complete wider turns while still encouraging slower turning speeds among passenger cars.

Reduce pedestrian and bicyclist exposure.

Narrower driveways and reduced turning radii have the additional benefit of reducing pedestrian crossing distances across driveway entrances. Reduced crossing distances reduce the time that pedestrians and bicyclists are exposed to drivers.

If driveway widths exceed 35 feet, pedestrian refuge islands should be provided. Pedestrian refuge islands reduce pedestrian exposure to turning cars and allow pedestrians and bicyclists to cross in two stages. They must be at least six feet wide, with a width of 8–10 feet preferred.



FIGURE 24 Driveway with sidewalk continuing across driveway opening



FIGURE 25 Bicycle conflict markings



FIGURE 26 Truck turning apron

4.6.2 Ring and Circulation Roads

Ring roads encircle larger parking facilities along their outer edge while circulation roads function as collectors and distributors, linking aisles and frontage roads (Figure 27). They may also connect adjacent parking lots. These roads manage larger volumes of traffic by distributing cars to aisles and access points and may intersect with pedestrian and bicyclist routes that lead to building entrances.

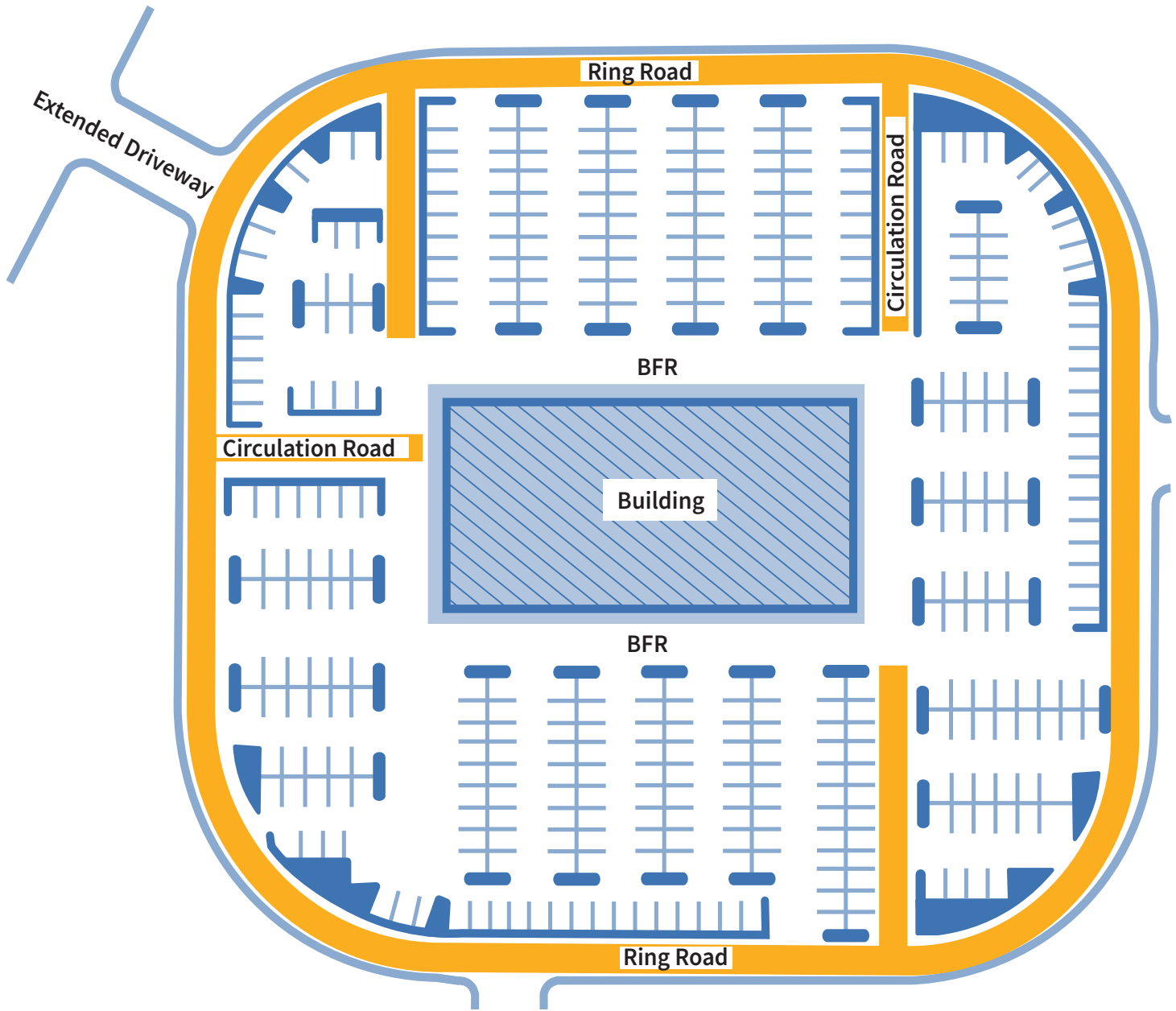


FIGURE 27 Illustrative circulation diagram depicting ring and circulation roads

4.6.2.1 Ring and Circulation Road Requirements

TABLE 14 Key Ring and Circulation Road Requirements

Design Element	Criteria	Reference
Width	Min. 20' wide if necessary for fire apparatus access.	
	Note. The Fire Department Performance-Based Guide distinguishes between “travel access” and “operational access,” establishes a 12' minimum for travel access, and advises that operational clear width can be made up of different design elements, including bike lanes, load-bearing medians, alternative load-bearing surfaces, etc., as reviewed and approved by MCDPS.	Montgomery County Code §22-32 Required access for fire apparatus NFPA 1 §18.2.3.4.1
Turning radius	Min. inside turning radius of 25' if used for fire apparatus access. Note. The Fire Department Performance-Based Guide indicates that curb radii may be reduced below 25' (down to 15' or less in Urban Road Code Areas) if effective clearance for fire department access is maintained.	NFPA 1 §18.2.3.4.2

4.6.2.2 Ring and Circulation Guidance

Do not terminate in a dead end

Ring and circulation roads should never terminate in a dead end. They should always connect to to other circulation roads or the BFR at endpoints.

Set a target operating speed of 20 mph.

Ring and internal circulation roads should be designed to produce maximum operating speeds of 20 mph. A 20-mph target speed reduces the risk of severe crashes and signals to drivers that they are approaching shared spaces with lower target speeds. While ideally, thoughtful parking lot layout design reduces the intersection of pedestrian, bicyclist, and vehicular circulation, certain conflicts may be unavoidable, making speed management an important aspect of safety-oriented design.

Improve safety at intersections with building frontage roads.

Ring and circulation road intersections with the BFR are also a point of interest. As identified in **Section 2.1, Key Safety Issues**, left-turning crashes are seen at these locations with some frequency. Many of the traffic calming countermeasures to target operational speeds of 20 mph or less are relevant in safer intersection design. Refer to **Section 4.6.3.2 BFR Guidance**, for more detailed guidance on improving intersection safety at BFR and ring and circulation road intersections.

Reinforce target speeds through geometry: traffic calming.

Operating speeds of 20 mph should be communicated to drivers through geometric means. While speed limit signs and pavement markings on circulation and ring roads should be provided to establish baseline expectations, geometric measures are the most reliable means of achieving and maintaining target speeds, as they communicate to drivers through the design of the built environment that they are transitioning from a street environment to a shared one.

Recommended measures include:

- **Narrower travel way widths** to increase driver attentiveness and make it less comfortable for drivers to travel at high speeds. Travel lanes should have widths between 10 and 11 feet, with 10 feet preferred.
- **Speed tables** to maintain consistently low speeds along longer roadway segments. Unlike speed humps, speed tables have a flat top that makes them more comfortable for bicyclists and emergency vehicles (**Figure 28**).
- **Curb extensions** to tighten turning radii, reduce car turning speeds, and improve sightlines at internal intersections by restricting parking, especially where a pedestrian facility is present. They also shorten pedestrian crossing distances and reduce pedestrian exposure (**Figure 29**).
- **Chokers** that narrow the travel way at a midblock location, creating a pinch point that encourages drivers to slow down. Chokers maintain adequate width for emergency vehicles while reducing the open feel of wider aisles (**Figure 30**).
- **Miniature roundabouts** for use at intersections with circulation roads. These features force drivers to reduce speed when entering and passing through an intersection (**Figure 31**).
- **Refuge islands** to support safer two-stage pedestrian crossings on ring roads and wider circulation roads. By providing a protected waiting area at the midpoint of a crossing, refuge islands allow pedestrians to cross one direction of traffic at a time, reducing exposure and improving safety on roads where crossing in a single stage would be difficult (**Figure 32**).



FIGURE 28 Curb extensions in a parking lot



FIGURE 29 Chokers



FIGURE 30 Roundabout in a parking lot



FIGURE 31 Pedestrian refuge island



FIGURE 32 Speed table

Ensure pedestrian visibility at ring road crossings.

Improving pedestrian visibility at crossings is especially critical on ring roads. Pedestrian travel across ring roads may occur due to the placement of parking stalls outside the ring road or, more commonly, because the ring road connects two adjacent surface lots. These crossings are higher risk due to higher vehicle speeds and sometimes the presence of multiple travel lanes in each direction. The combination of multi-lane geometry and higher traffic volumes increases the likelihood of the “multiple threat” crash, where one driver yields to a pedestrian but obscures them from the view of an adjacent driver.

To address these risks, the visibility and predictability of pedestrian crossings on ring roads are essential. Recommended design strategies include:

- Locating stalls inside the ring road to minimize pedestrian crossings of high-volume travel ways.
- Installing high-visibility crosswalks at regular intervals and along logical pedestrian desire lines.
- Channelizing pedestrians to marked crossings using treatments such as landscaping or fencing to discourage midblock crossings.
- Implementing measures to further enhance visibility and safety at multi-lane crossings, including:
 - Advanced stop bars and yield markings set back from crosswalks.
 - Yield signage reminding drivers of pedestrian priority.
 - Rectangular Rapid Flashing Beacons, pedestrian-hybrid beacons, or other active warning devices to reinforce pedestrian presence **(Figure 33)**.
 - Traffic signals where traffic, pedestrian activity, safety concerns, or network operations justify signal control.

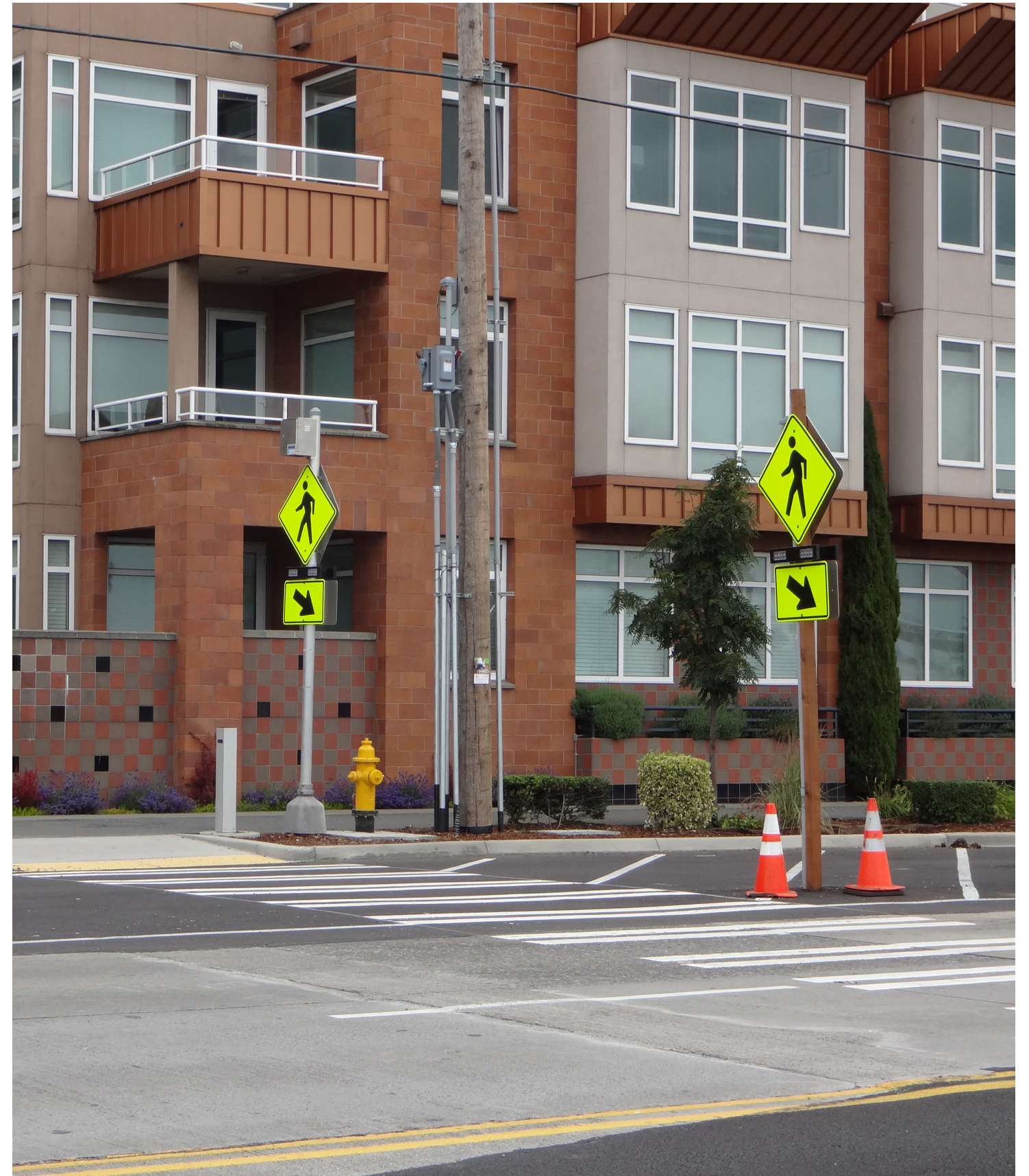


FIGURE 33 Rectangular Rapid Flashing Beacons

4.6.3 Building Frontage Roads

Safe design of BFRs is among the interventions with the most potential to improve overall parking lot safety (Figure 34). These roads’ location alongside the building frontage means that BFRs tend to concentrate both vehicle and pedestrian activity, as pedestrians and bicyclists accessing buildings almost always cross the BFR, and cars often use this road to circle the lot. This results in a high number of interactions and potential conflicts between pedestrians, bicyclists and circulating cars. With the magnitude of conflicts in mind, BFRs should be designed as a shared space.

The following sections address key strategies for designing safer BFRs, including traffic calming to manage speeds, circulation design to reduce volumes, pedestrian crossings to improve visibility, and installing end islands to enhance sight lines at crossing points.

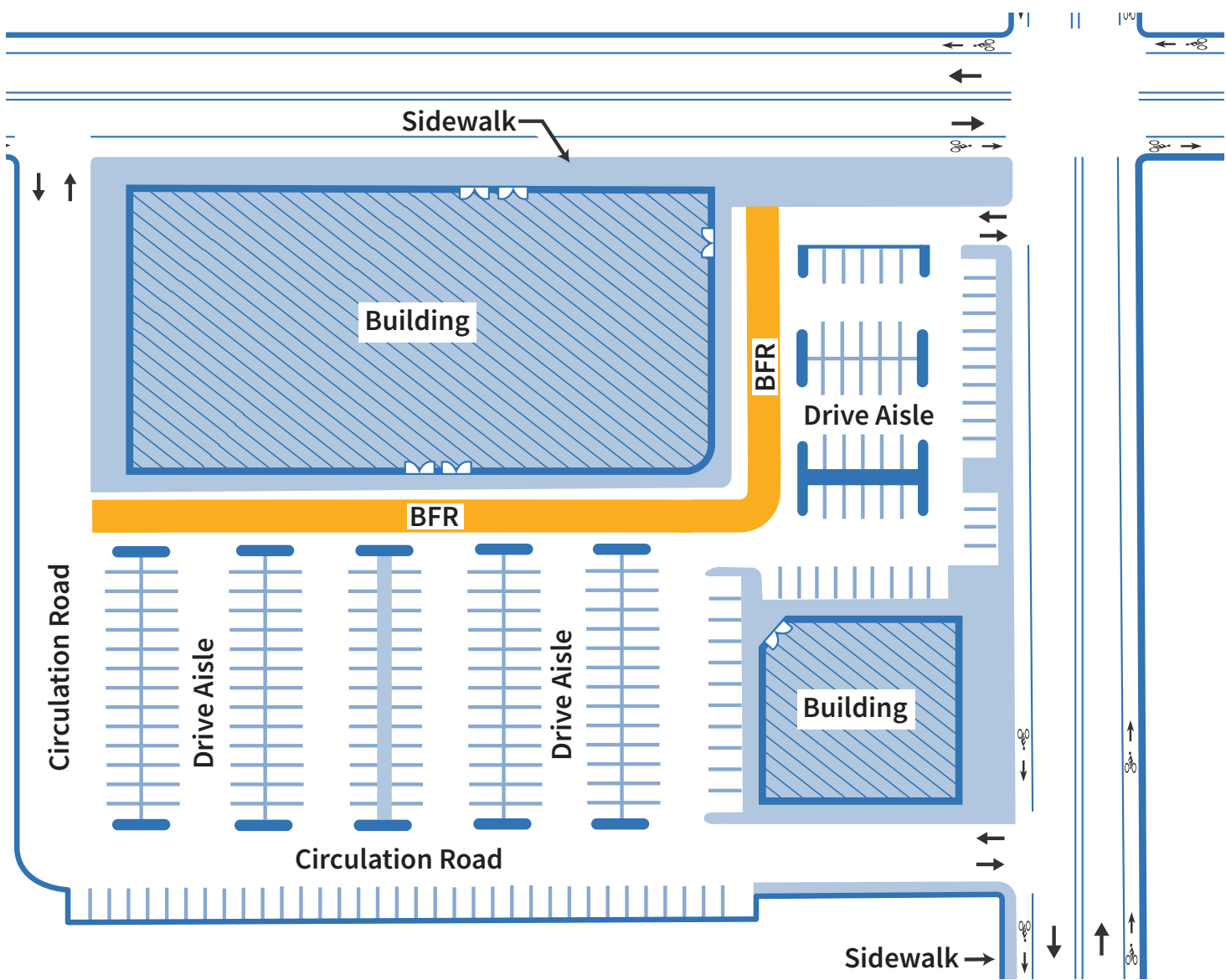


FIGURE 34 Illustrative circulation diagram depicting a BFR

4.6.3.1 BFR Requirements

The requirements for BFRs are the same as those for ring and circulation roads, which are summarized in Key Ring and Circulation Road Requirements.

4.6.3.2 BFR Guidance

Do not terminate in a dead end

BFRs should never terminate in a dead end. They should always connect to circulation roads at endpoints.

Set a target operating speed of 15 mph or lower.

Maximum operating speeds on BFRs should be 15 mph, with 5–10 mph preferred. These operating speeds enable safe and comfortable travel for all users.

Design using shared space principles.

Due to the high volume of pedestrian and bicyclist crossings along the BFR at multiple locations, BFRs should be designed according to shared space principles. Shared spaces are designed to prioritize people by creating environments where all users move carefully, remain aware of one another, and share responsibility for navigating the space. Lower speeds support these environments by giving drivers more time to react and reduce the risk of severe injuries if someone makes a mistake (Figure 35).



FIGURE 35 BFR designed as shared space

Reinforce target speed through geometry, traffic calming, and signage.
Narrow travel lanes are essential to achieving car operating speed targets of 15 mph and lower on BFRs, as they encourage slower driving by increasing driver attentiveness and reducing the perceived comfort of higher speeds.

- Travel lanes should be 10 feet wide.
- On two-way BFRs, this results in a total pavement width of 20 feet.
 - On one-way BFRs, performance-based fire access needs require 12 feet of traversable pavement. Designers should use striped buffers or edge lines to visually reduce the BFR to 10 feet.

Designers should note that narrower BFR configurations may not be appropriate in every context. For example, hospitals and medical facilities with significant emergency medical service access needs may require wider BFRs to accommodate emergency vehicles.

- In addition, traffic calming elements and signage should be incorporated to reinforce slow speeds. Recommended measures include:
- Raised pedestrian crossings to slow cars and prioritize pedestrian movement (**Figure 36**).
 - Curb extensions that shorten crossings, reduce car turning speeds, and improve pedestrian visibility.
 - Advisory speed limit signs reflecting the target speed for the BFR.

Speed humps and bumps should be avoided, as they create tripping hazards, particularly for older adults and people with disabilities.



FIGURE 36 Raised crossing across BFR

Improve safety at intersections.
Intersections along the BFR are frequent crash locations, particularly crashes involving left-turning cars. BFR-aisle and BFR-circulation road intersections have different characteristics, and pedestrian exposure levels and should be designed accordingly.

- BFR-Aisle Intersections**
Because BFR-aisle intersections function primarily as shared spaces with significant pedestrian activity, counter-measures that restrict vehicle movements—such as hardened centerlines—are not appropriate. Designers should instead use the following measures to improve safety at these intersections:
- **End islands** should be installed at BFR-aisle intersections to prevent cars from parking at corners, preserve sight distance between drivers and pedestrians, and channelize vehicle movements. Curb radii at end islands should be tightened to five feet to reduce turning speeds. End islands can also incorporate landscaping or stormwater management features. See **Figure 37**.
 - **Stop signs:** Install a stop sign at the end of the aisle to encourage drivers to stop before they turn onto the BFR.



FIGURE 37 Stormwater management on end islands

BFR-Circulation Road and BFR-Ring Road Intersections

In contrast to BFR-aisle intersections, BFR-circulation road intersections are not treated as shared spaces, as pedestrian activity is less frequent. In addition, these intersections typically have a larger physical footprint. As such, different countermeasures should be considered:

- **Miniature roundabouts:** These are small, low-speed roundabout treatments that require entering cars to yield and navigate around a central island. They reduce conflict points, slow vehicle speeds, and improve safety, including eliminating left-turn conflicts entirely by converting movements into circulating right turns. The central islands can also be made mountable to allow for emergency vehicle access. See **Figure 38**.
- **Pavement markings and signage:** Designers should apply high-visibility crosswalk markings and yield control at BFR crossings, along with stop control on the circulation/ring road approaches, to clearly define right-of-way and prioritize crossing users.
- **Perpendicular intersection design:** Intersections should be designed to be as close to 90 degrees as possible to minimize crossing distances for pedestrians and limit sight distance issues.



FIGURE 38 Roundabout with a mountable center island

4.6.4 Drive Aisles

Drive aisles are internal circulation routes that function as part of both the car and pedestrian circulation networks. They provide vehicular access to parking stalls, loading areas, and building entrances, while also serving as spaces where pedestrians travel between parked cars and building entrances.

Drive aisles should be designed to support low vehicle speeds, including turning and maneuvering, as these are areas of heightened pedestrian risk. Most pedestrian crashes within parking areas occur in drive aisles, often when drivers are backing out of stalls. Due to this overlap between car and pedestrian activity, drive aisles must be carefully designed to balance pedestrian visibility, car speeds, and accessibility for all users.

4.6.4.1 Drive Aisle Requirements

Drive aisles must meet minimum width requirements in [Montgomery County Zoning Ordinance 59.6.2.5.G](#) based on parking stall configuration and aisle travel direction, as shown in ~~Drive aisles must meet minimum width requirements in Montgomery County Zoning Ordinance 59.6.2.5.G based on parking stall configuration and aisle travel direction, as shown in Table 15.~~

TABLE 15 Minimum Drive Aisle Width by Parking Stall Orientation and Drive Aisle Direction of Travel

Parking Stall Orientation	One-Way Drive Aisle	Two-Way Drive Aisle
Perpendicular	20’	20’
60 to 75 degrees	18’	20’
45 to 59 degrees	16’	20’
Parallel	10’	20’
No parking on drive aisle	10’	20’

4.6.4.2 Drive Aisle Guidance

Orient aisles perpendicular to building frontage to reduce pedestrian and vehicle conflict.

Aisles should be oriented perpendicular to the building frontage wherever feasible, as seen in **Figure 39**. This configuration channels pedestrians along a predictable path toward building entrances, making their movements easier for drivers to anticipate. It also increases pedestrian visibility, as it provides a clear path for pedestrians to walk along, unobscured by parked cars. In addition, this configuration channels pedestrians to defined crossing locations across the BFR, where visibility treatments such as marked crosswalks, end islands, and curb extensions can be applied most effectively. For more information on increasing pedestrian visibility at BFR-aisle intersections, refer to the discussion of BFR-Aisle Intersections in the prior section.

Where site constraints prevent perpendicular aisle orientation, a designated pedestrian pathway or centerwalk must be provided through the lot, as seen in **Figure 12**.

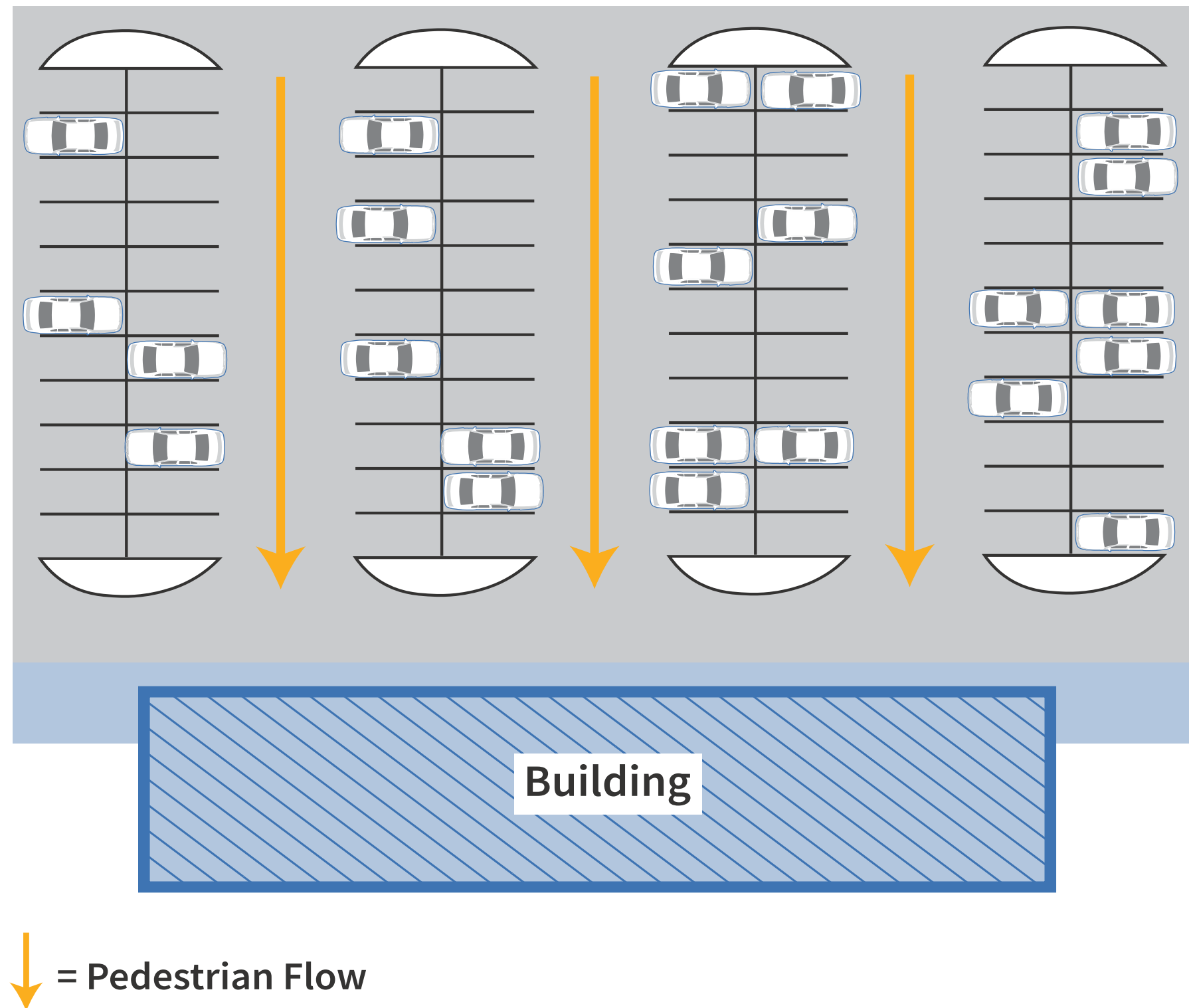


FIGURE 39 Aisles arranged perpendicular to building frontage

Consider pedestrian volumes and parallel centerwalks when determining drive aisle widths.

Drive aisles must meet minimum width requirements in ~~Montgomery County Zoning Ordinance 59.6.2.5.G~~ based on parking stall configuration and aisle travel direction, as shown in Table 15. In areas where moderate to high pedestrian volumes are expected—particularly where no parallel centerwalk is provided—wider drive aisles should be considered. Increasing aisle widths by approximately four to six feet above the minimum (based on anticipated pedestrian activity and the direction of vehicular travel) can improve pedestrian safety and comfort. Wider aisles provide pedestrians with additional space to navigate around backing and circulating cars, helping to reduce the risk of pedestrian–motor vehicle conflicts and improving the overall pedestrian experience.

Limit aisle length to reduce vehicle speeds.

Aisle length should be minimized to reduce the speeds of circulating cars. Designing for low car speeds in drive aisles is critical as pedestrians often travel through aisles even in the presence of separate pedestrian facilities. Aisle lengths under 350 ft are recommended. This maximum length aligns with the recommended spacing between circulation roads and ~~BER's~~ and with the recommended length for pedestrian friendly street-blocks, in case of future development. For related guidance on aisle width, refer to previous section.

Consider visual treatments to reduce vehicle speeds

Contrasting pavement colors or materials placed along the middle of the aisle may serve to visually narrow wide parking aisles. These treatments are not meant to designate the division between car and pedestrian space, but rather they should create a yield-street like visual effect. If differentiating pavement colors or textures are used, they should be placed in the middle of the aisle and be 14'-16' wide.

Install landscape dividers to prevent cut-through driving.

Landscape dividers are landscaping strips installed parallel to parking aisles that physically prevent drivers from cutting across the lot through parking stalls. By channelizing cars into predictable circulation patterns, landscape dividers reduce unexpected vehicle movements that can increase conflict points with pedestrians walking along aisles.

Cut-through driving is most common toward the rear of parking lots, where fewer occupied stalls and open expanses of pavement encourage drivers to take shortcuts. Landscape dividers are therefore most critical in these areas, though designers should provide them throughout the lot to discourage excessive cut-through movements.

Although landscape dividers reinforce the desired vehicular circulation pattern, designers should not install them at every parking bay. Instead, they should be alternated between bays to allow some drivers to pull through vacant opposing stalls, reducing backing movements. See **Figure 40**.

In addition to their safety function, landscape dividers can incorporate stormwater management features such as bioretention areas, provide shade through tree plantings, and improve the overall comfort and aesthetic quality of the lot. For additional information on stormwater management in parking lots, see ~~Section 4.25 Stormwater Management~~.

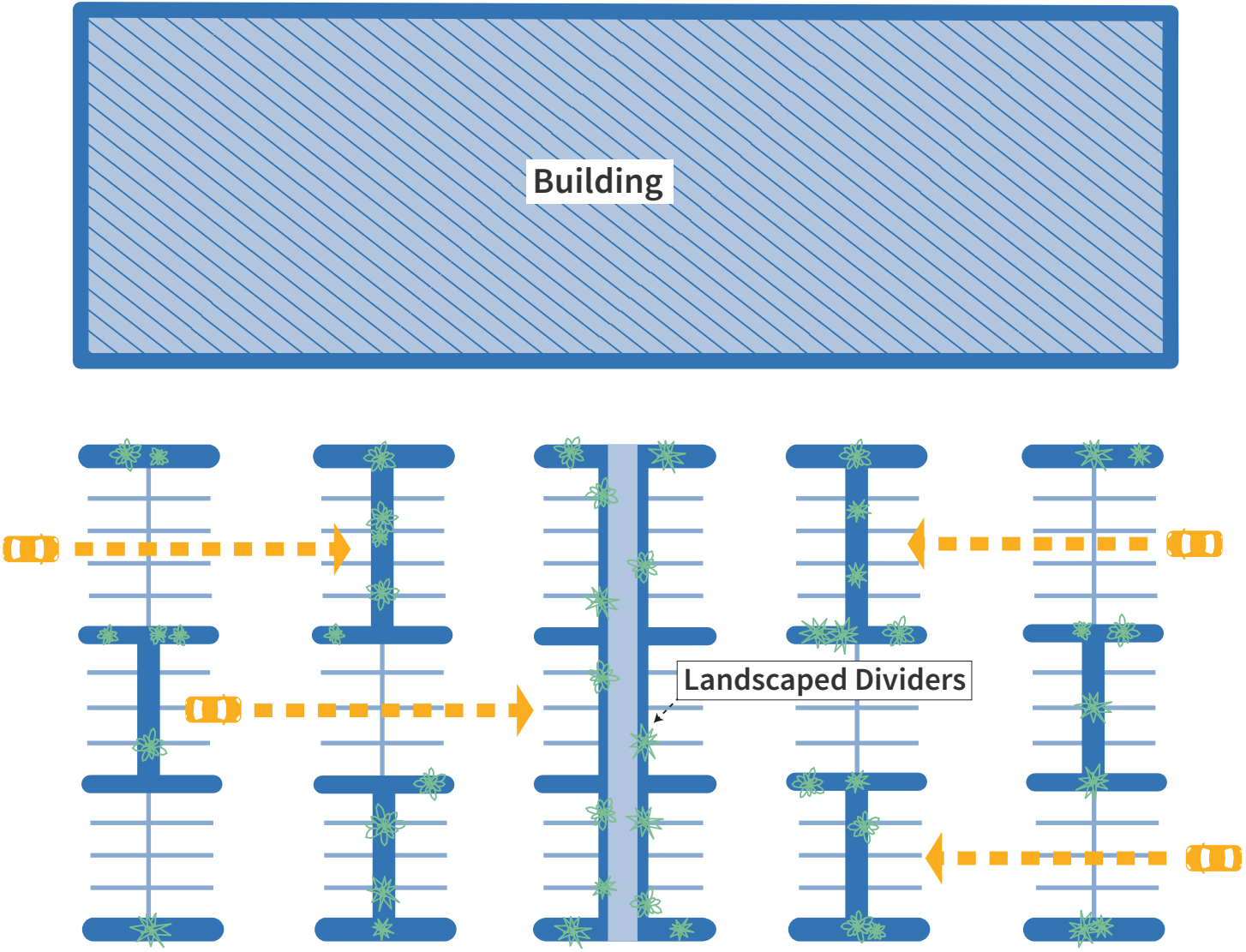


FIGURE 40 Landscaped dividers alternating between bays

4.7 Motor Vehicle Parking

4.7.1 Motor Vehicle Parking Requirements

4.7.1.1 Standard Spaces

Standard spaces must meet the minimum dimensional requirements in [Montgomery County Zoning Ordinance 59.6.2.5.G](#), which are reproduced in **Table 16** and **Table 17**.

TABLE 16 Standard Spaces—Minimum Dimensional Requirements

Parking Angle	Space Width	Space Length
Perpendicular	8.5’	18’
60°–75°	10’	23’
45°–59°	12’	26.5’
Parallel	7’	21’

TABLE 17 Compact Spaces—Minimum Dimensional Requirements

Parking Angle	Space Width	Space Length
Perpendicular	7.5’	16.5’
60°–75°	8.5’	21’
45°–59°	Prohibited	Prohibited
Parallel	6’	19.5’

4.7.1.2 Accessible Spaces

Accessible spaces must comply with [ADA Standards 502](#), which are summarized in **Table 18**, and shown in **Figure 41**.

TABLE 18 Key Accessible Parking Space Requirements

Design Element	Criteria	Reference
Standard accessible space	Min. width 8’, min. length not specified	ADA Standards 502.2
Van-accessible space	Min. width 11’, min. length not specified	ADA Standards 502.2
Access aisle	•Adjacent access aisles required for all accessible spaces (i.e., standard and van-accessible). •Min. width 5’. Min. length as long as parking space. •Must adjoin an accessible route complying with ADA Standards Chapter 4, which is summarized above in Section 4.5, 4.3.1.1. Accessible Route Requirements. •Must connect parking spaces to accessible entrances. •Must be marked to discourage parking in them. •Must not overlap the vehicular way. •May be placed on either side of a parking space, except for angled van parking spaces, which require access aisles on the passenger side. •Two accessible spaces may share a common access aisle.	ADA Standards 502.2 ADA Standards 502.3
Floor and ground surfaces	•Parking spaces and access aisles serving them shall comply with ADA Standards 302, which are summarized above in Section 4.5, 4.3.1.1. Accessible Route Requirements. •Access aisles must be at the same level as the parking spaces they serve. Changes in level are not permitted. EXCEPTION: Slopes not steeper than 1:48 shall be permitted.	ADA Standards 502.4
Vertical clearance for parking spaces and access aisles	Min. 8’	ADA Standards 502.5
Identification	•Must include the International Symbol of Accessibility complying with ADA Standards 703.7.2.1. •Signs identifying van parking spaces must contain the designation “van accessible.” •Signs must be min. 5’ above the finish floor or ground surface measured to the bottom of the sign.	ADA Standards 502.6
Relationship to accessible routes	Spaces must be designed so that cars and vans, when parked, cannot obstruct the required clear width of adjacent accessible routes.	ADA Standards 502.7

4.7.2 Motor Vehicle Parking Guidance

4.7.2.1 Choose stall orientation to improve visibility.

Stall orientation, seen in (Figure 42), affects driver visibility when exiting a stall. Orientations should be selected according to the following hierarchy:

- **Back-in angled stalls are preferred.** This configuration allows drivers to complete the backing-in maneuver with clear sightlines and exit the stall while facing forward. This provides drivers with full visibility of pedestrians and circulating cars, eliminating the risky backing out reverse movement. Back-in angled stalls require one-way circulation. Although this circulation pattern is not preferred, as it may increase circulating vehicle speed, the safety advantages of improved backing out maneuvers outweigh the disadvantages.
- **Perpendicular (90-degree) stalls** are the next best option. Where opposing stalls are vacant, drivers can pull through and exit facing forward, reducing backing maneuvers and improving visibility. Perpendicular stalls also allow drivers to back in, providing visibility benefits similar to back-in angled stalls.
- **Front-in angled stalls** should be avoided. They offer the least visibility during backing out maneuvers, and they necessitate one-way circulation patterns, which present safety disadvantages.

4.7.2.2 Use wheel stops to prevent vehicular overhang.

Wheel stops should be installed at the front of stalls when adjacent to sidewalk. At this location wheel stops do not present a tripping hazard and prevent vehicle overhang from reducing the usable width of the pedestrian route. For additional guidance on how to reduce vehicular overhang, see **Section 4.3.2 Accessible Route Guidance.**

4.7.2.3 Provide additional accessible spaces.

The number of accessible parking spaces provided should exceed the minimum required by the ADA. All accessible parking spaces should be van accessible. Van-accessible spaces accommodate a wider range of users, including those who require additional space to deploy mobility equipment, and reduce the likelihood of access aisle violations by providing sufficient space for users to exit their cars on either side. For minimum accessible parking space requirements, see **Section 4.7.1.2 Accessible Spaces.**

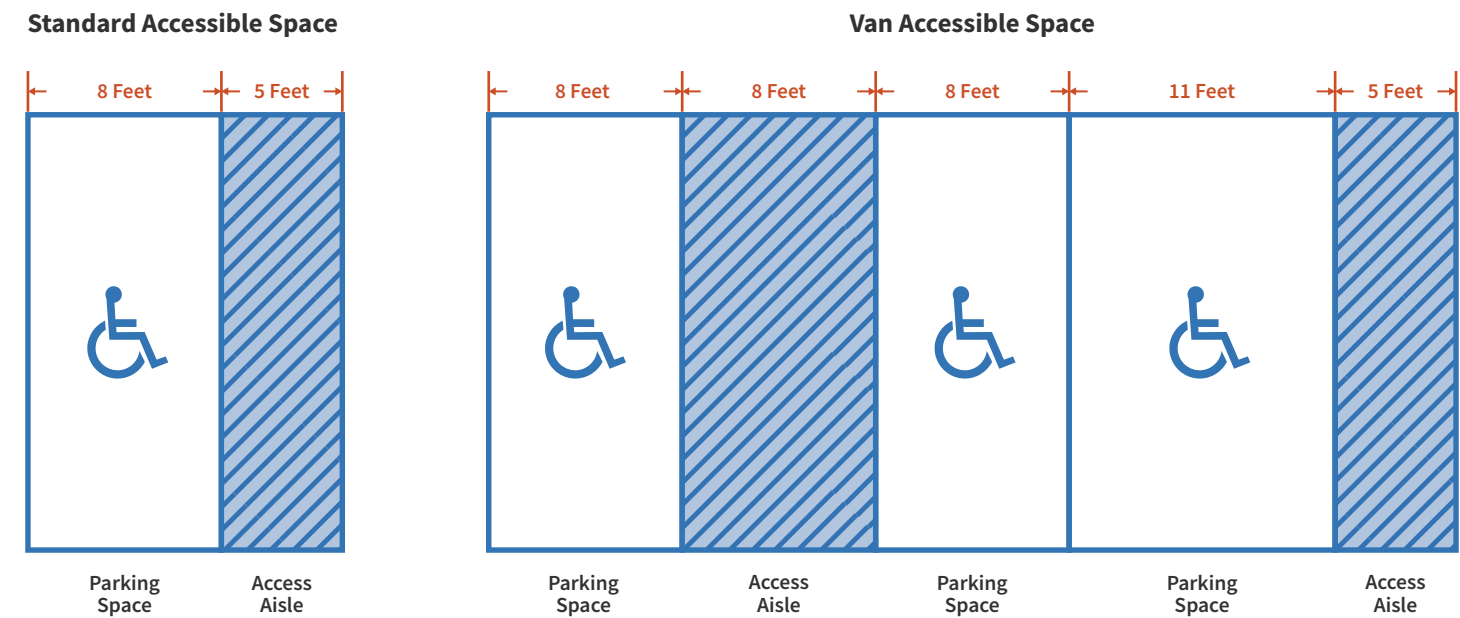


FIGURE 41 Accessible parking requirements

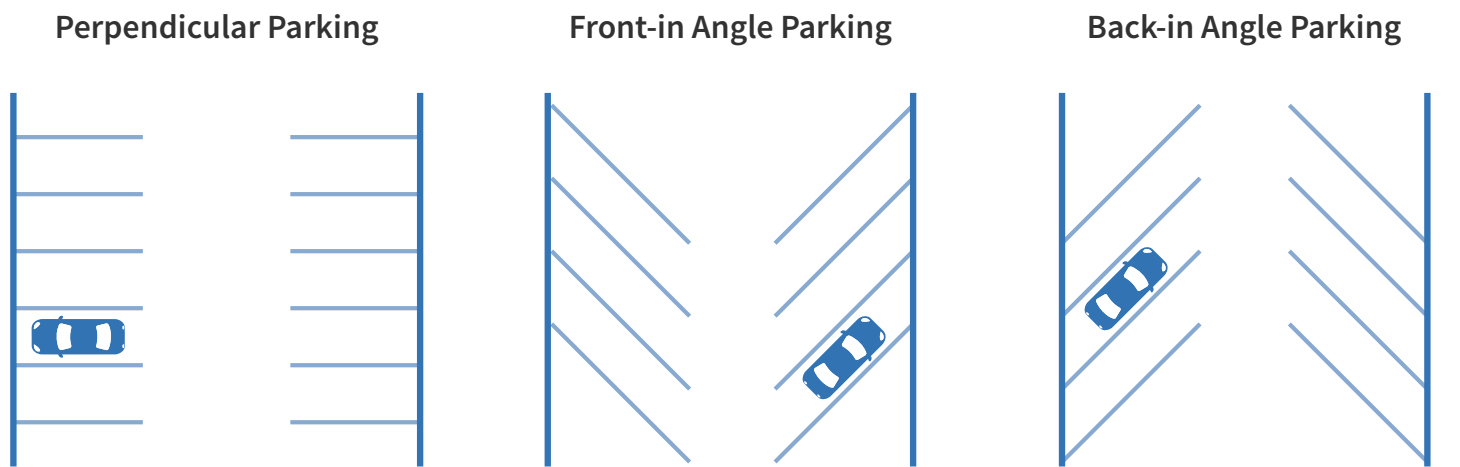


FIGURE 42 Differences between back-in angle, perpendicular and front-in angle stalls

4.8 Loading Zones

Vehicle loading and unloading areas within parking lots support short-term stopping for goods delivery, service access, and passenger pick-up and drop-off. These activities are essential to site function but introduce additional conflicts within parking areas, particularly when they occur on the BFR or near primary pedestrian routes.

4.8.1 Loading Zone Requirements

TABLE 19 Key Loading Zone Requirements

Design Element	Criteria	Reference
Location	• Must be located within the same development as the building or use served. • Prohibited from projecting into a sidewalk, street, or public right-of-way. • Prohibited from being located between the front building line and the lot line.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.8.C
Dimensions	• Min. 10’ wide, 30’ long, and 14’ high if it serves single-unit trucks and similar delivery vehicles. • Min. 12’ wide, 55’ long, and 15’ feet high if it serves larger freight vehicles.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.8.C
Maneuvering	• Maneuvering area must be located on-site and be a minimum of: • 30’ for spaces serving single-unit trucks and similar delivery vehicles; and • 50’ for spaces serving larger freight vehicles.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.8.C
Surfacing	Must be paved with durable, all-weather material, such as concrete or asphalt.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.8.C
Safe design	Must be designed and located to minimize conflicts with other vehicular, bicycle, and pedestrian traffic.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.8.C

4.8.2 Loading Zone Guidance

Place loading zones to reduce conflicts.
Loading activity can disrupt circulation, reduce visibility, and increase the potential for conflicts between cars and pedestrians. Frequent stopping, backing movements, and the presence of larger delivery vehicles can create unpredictable conditions, especially in areas with high pedestrian activity.

Where possible, commercial loading and service deliveries should be located behind buildings or in designated service areas, separated from building frontage roads and pedestrian zones. This reduces conflicts and helps maintain a safer and more organized circulation pattern.

When loading and unloading must occur on the BFR, designated spaces should be clearly defined and located to minimize interference with drive aisles and pedestrian through-routes. These areas should be designed to support safe maneuvering, maintain clear sightlines, and reduce the need for backing movements in high-traffic areas.

4.9 Other Design Considerations

4.9.1 Lighting

Lighting is one of the most effective design features for improving personal and pedestrian safety in parking facilities. Although illumination levels should be tailored to the expected use and risk of a parking facility, lighting design at all parking facilities should at minimum meet the standards established by the Illuminating Engineering Society of North America (IESNA) and should comply with the general guidance provided by Dark Sky International for responsible outdoor lighting.⁵

4.9.1.1 Lighting Requirements

TABLE 20 Key Lighting Requirements

Design Element	Criteria	Reference
Fixture (luminaire)	Must be full or partially cut-off fixture.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.4.4.B General Outdoor Lighting Requirements
Fixture height	•Max. height 30’ for lot with 0–99 spaces. •Max. height 40’ for lot with 100+ spaces •Max. height 15’ for pedestrian area. •Max height 15’ for fixtures within 35 feet of a lot line of a detached house building type not located in a Commercial/Residential or Employment zone.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.4.4.B General Outdoor Lighting Requirements
Light source (lamp)	Must use incandescent, fluorescent, light-emitting diode (LED), metal halide, or color-corrected high-pressure sodium, unless the applicable deciding body approves an alternate light source based on new technology.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.4.4.B General Outdoor Lighting Requirements
Illumination at lot line	Max. 0.5 footcandles, excluding streets lights within the right-of-way.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.4.4.D General Outdoor Lighting Requirements
Conditional uses	Outdoor lighting must be directed, shielded, or screened to ensure that the illumination is 0.1 footcandles or less at any lot line that abuts a lot with a detached house building type, not located in a Commercial/Residential or Employment zone.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.4.4.E General Outdoor Lighting Requirements
In public right-of-way	Must comply with Montgomery County Street Light Design Requirements.	Montgomery County Streetlight Design Requirements

⁵ The County requires site plan applicants to provide certification from a qualified professional that the exterior lighting conforms to the latest IESNA recommendations. Additionally, all onsite down-lights must have full cut-off or BUG-equivalent fixtures and deflectors must be installed on fixtures to prevent excess illumination and glare.

4.9.1.2 Lighting Guidance

Effective lighting requires attention to several interrelated qualities, including overall brightness, uniformity, directionality, and glare control

Ensure adequate and uniform horizontal illuminance for safety and visibility.

Illuminance refers to the amount of light reaching a surface, with horizontal illuminance specifically referring to the brightness of the ground surface. While lighting should meet the minimum illuminance standards established by IESNA for the facility type and anticipated activity level, only meeting minimum illuminance levels is not sufficient. Lighting must also be distributed uniformly across all driving, parking, and walking surfaces. Large contrasts between brightly lit and dark areas impair the eye’s ability to adjust, creating discomfort and increased risk for both drivers and pedestrians. (Figure 43).

Choose a lighting warmth that balances ambiance and safety

Color temperature, measured in degrees Kelvin (K), describes whether light appears warm and yellowish or cool and bluish. The choice of color temperature in a surface lot affects not only visibility but also the general ambiance and perceived safety of the environment.

Cooler light temperatures (4000K–5000K) enhance contrast and visibility over large areas, making them well suited for expansive lots, such as large retail lots, where illuminating wide distances and supporting driver and pedestrian visibility is the primary concern. However, high color temperatures may create an industrial, unwelcoming feel at the site and cause excessive glare that can impair visibility. Warmer light temperatures (3000K–3500K) produce a softer, more welcoming feel and are less likely to cause glare, making them a better fit for smaller, or urban, and mixed-use locations where pedestrian comfort and the character of the surrounding context are important design considerations.

Generally, designers should default to the warmest color temperature that meets applicable illumination requirements for the facility. Cooler temperatures should be reserved for contexts where visibility demands across large areas cannot otherwise be met.

Provide sufficient vertical illuminance for visibility and personal security.

While horizontal illuminance is the most measured lighting metric, it does not capture whether faces, signs, and potential hazards are visible at standing height. Vertical illuminance, which measures light on a vertical plane at standing height, should be sufficient to support personal security and pedestrian safety, particularly along pedestrian routes and near building entrances.

Minimize glare with shielded, downward-directed lighting.

Glare should be minimized through appropriate fixture selection and placement. Excessive brightness reduces contrast and depth perception, particularly for older adults and people with vision disabilities. Fixtures should be fully shielded and downward-directed to minimize glare, light pollution, and off-site light spillage, in accordance with dark sky best practices.

Maintain lighting through regular inspection and group relamping.

Lighting should be inspected on a regular schedule to prevent illuminance levels from degrading below target thresholds. Group relamping—replacing all fixtures in an area at once rather than individually—is recommended to maintain consistent illuminance levels across the facility.



FIGURE 43 Event lighting demonstrates how warm lighting and active use support perceived safety after dark

4.9.2 Personal Security

Natural surveillance, the ability of users and passersby to passively observe activity across a parking facility, is a key deterrent to crime and improves perceived safety. Surface parking lots are well suited to natural surveillance given their open layout, but design decisions, such as landscaping that is too tall and dense, can inadvertently undermine visibility.

4.9.2.1 Personal Security Guidance

Mindfully implement perimeter screenings to maintain visibility.

Dense perimeter plantings that fully screen the lot from adjacent streets and properties should be avoided, as they eliminate passive oversight from people outside the facility. Where screening is required for aesthetic or other purposes, it should be designed to preserve sightlines into the lot. Low-growing shrubs, open fencing, or spaced tree plantings are preferred over dense and tall plantings or solid walls.

Design internal landscaping with visibility in mind.

Landscaping within the lot should be designed and maintained to maximize visibility. Plantings near pedestrian paths, corners, and entrances should be kept low to preserve sightlines between drivers, pedestrians, and passersby. Plantings along walking routes that create concealed areas or substantially reduce visibility due to planting density or height should be avoided.

4.9.3 Green Infrastructure

4.9.3.1 Green Infrastructure Requirements

TABLE 21 Key Green Infrastructure Requirements

Design Element	Criteria	Reference
Landscaping for conditional uses requiring 5–9 parking spaces	If abutting Agricultural, Rural Residential, or Residential Detached zoned property that is vacant or improved with an agricultural or residential use: •Must have a perimeter planting area that satisfies a min. setback under Montgomery County Zoning Ordinance Article 59-4 or, if not specified, be at least 8’ wide. •Must contain a hedge, fence, or wall that is min. 4’ tall, and a min. of one understory or evergreen tree planted every 30’ on center.	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.9.B
Landscaping for lots with 10+ parking spaces	Landscaping: •Provide landscaped islands totaling at least 5% of the lot area, each at least 100 sq ft. •Preserve existing trees where possible. •No more than 20 spaces between islands. •Landscaped areas may be used for stormwater management. Tree canopy: •Maintain at least 25% tree canopy coverage within 20 years. Perimeter planting: •Adjacent to agricultural/residential uses: • Minimum 10’ wide buffer • 6’ high hedge, fence, or wall • Canopy tree every 30’ • Two understory trees per canopy tree •Adjacent to other uses or rights-of-way: • Minimum 6’ wide buffer • 3’ high hedge or low wall • Canopy tree every 30’ • Not required if next to another parking lot	Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.9.C

4.9.3.2 Green Infrastructure Guidance

Parking lots can address environmental and public-realm concerns beyond crash reduction. Although green infrastructure interventions are not the focus of this guide, designers should be aware of general high level green infrastructure principles that may be incorporated as they design surface lots, as thoughtful integration of native canopy trees, pervious and reflective surfaces, and green infrastructure measures can reduce environmental impacts, improve user comfort, and enhance the overall quality of a site.

Use canopy trees to reduce temperatures within the lot.

Native canopy trees should be provided throughout the lot to reduce ambient temperatures, mitigate urban heat island effects, and provide shade for pedestrians and parked cars. Where feasible, designers should aim for canopy trees to be planted ~~very~~ five parking spaces. Trees should be hardy, native-grown species suited to urban conditions, selected for resistance to disease, tolerance of normal rainfall, and a long lifespan.

Use enough soil volume to ensure healthy tree growth.

Adequate soil volume should be provided to support healthy tree growth. Structural soils or soil cells are recommended where paved surfaces limit available soil volume, as insufficient soil volume is a leading cause of poor tree establishment and premature decline in parking lot environments.

Incorporate planting zones throughout the lot.

Large expanses of paved surface should be broken up with planting zones to improve pedestrian comfort, reduce ambient heat, and enhance the aesthetic quality of the facility. Planting zones should be distributed throughout the lot rather than being concentrated at the perimeter and can be incorporated as end islands and landscape dividers. Deep-rooted shrubs and trees have additional benefits, as they intercept and absorb rainfall, reducing runoff volumes, while canopy trees provide shade that further reduces ambient heat and mitigates the urban heat island effect.

4.9.4 Stormwater Management

Parking lots generate significant stormwater runoff due to their large impervious surfaces. Integrating stormwater management features on-site reduces runoff volumes, improves water quality, and supports a healthier urban ecosystem.

4.9.4.1 Stormwater Management Requirements

TABLE 22 Key Stormwater Management Requirements

Design Element	Criteria	Reference
Coverage and purpose	•All above-ground stormwater management easements must be landscaped to improve aesthetics, water quality, and wildlife habitat. •At least 40% of the plantable area must be vegetation other than turf grass.	DPS Landscape Design Guidelines
Design character	•Facilities must have irregular, naturalistic outlines (no rectangular basins).	DPS Landscape Design Guidelines
Limitations	•No vegetation in the sand filter. •No woody vegetation in the grass filter above the sand filter. •Landscaping must not impede flow of water in the facility or impede the function of the facility.	DPS Landscape Design Guidelines
Access	•Landscaping may not obstruct maintenance access.	DPS Landscape Design Guidelines

4.9.4.2 Stormwater Management Guidance

Incorporate bioretention features.

Bioretention areas, rain gardens, and grassy swales may be integrated throughout the lot to capture and treat runoff before it leaves the site. These features should be located and sized to intercept runoff from adjacent paved surfaces and should be incorporated into planting zones and landscape dividers wherever feasible.

Use permeable surfaces.

Permeable surface materials should be incorporated into parking lot design to reduce runoff volumes and improve on-site infiltration. Suitable materials include permeable asphalt, permeable concrete, and natural stone and grass grid pavers. These surfaces are particularly appropriate in lower-traffic areas such as parking stalls, though some may be less durable and present accessibility challenges if they are not regularly maintained. When permeable surface materials are used on an accessible route, permeable asphalt or concrete is preferred, as other porous materials may require careful and consistent maintenance in order to meet ADA requirements.

Provide regular maintenance.

Stormwater features require seasonal monitoring and maintenance to remain effective. Plantings should be managed to prevent encroachment into adjacent walkways or pedestrian routes, and to ensure that overgrowth does not reduce visibility at key locations within the lot.

4.9.5 Incorporating Human-Scale Design

While the primary intent of this guide is to provide design guidance that enhances the safety of pedestrians, bicyclists and drivers in parking facilities, incorporating human-scale design choices can improve the feel of the facility, enhance comfort and promote safety by communicating that the site is shared between people and vehicles. Additionally, incorporating safety interventions that account for the aesthetics and comfort of the site allows parking lots to reflect their surrounding community context and flexibly serve additional uses. This can be accomplished through thoughtful decision-making concerning planting, materials, furnishings and layout to create legible, comfortable environments that safely support human and vehicular activity.

Incorporate trees and plantings.

Trees and planting should be used to frame pedestrian routes, screen parked cars from view, and provide shade for users traveling through the lot. Designers should prioritize shade trees near desirable pedestrian facilities, such as centerwalks, to encourage pedestrians to use these routes instead of traveling through drive aisles. Canopy trees are particularly effective, as they define space and improve the aesthetic character of the facility without obstructing sightlines at the pedestrian level. Placing trees and landscaping along the BFR furnishing zone and along the outer edges of centerwalks also serve to provide both vertical and horizontal separation for cars.

Use materials and surface treatments to distinguish pedestrian and vehicular spaces.

Materials and surface treatments can be used to distinguish pedestrian spaces from vehicle travel ways. Contrasting pavement colors, textures, or materials at crossings, centerwalks, and building entrances signal to drivers that they are entering a pedestrian priority area and should drive with caution. In addition, the materials present an opportunity to add visual interest to the lot and visually tie into the character of the surrounding context.

Use furnishings strategically.

Site furnishing should be used to enhance the human-scale quality of the site and provide additional vertical separation from circulating vehicles. Lighting fixtures should be human-scale at all dedicated pedestrian facilities to center pedestrian comfort. Placing lighting, as well as other amenities, including benches, waste receptacles, and bike racks on the outer edge of centerwalks or BFR sidewalk's furnishing zone provides additional protection to pedestrians and demonstrates consideration of the pedestrian user experience. When deciding the placement of furnishings, designers should also consider alternative uses of the parking lot. For example, installing benches at centerwalks provides additional seating throughout the site, which may be especially valuable when the lot is used for events such as community gatherings or farmers markets.

Additionally, furnishings with considerable vertical heights, such as banners and shade structures can be incorporated to provide both visual interest and reduce the overall scale of surface lots.

Incorporate placemaking.

Although surface lots are seen as detrimental to creating a sense of place, and placemaking mitigation strategies are generally limited to screening lots from the street, designers should be aware of the opportunities within surface lots to contribute to the identity and character of the surrounding community. Integrating artistic and placemaking elements — such as distinctive wayfinding signage, banners, murals, or other visual features — can transform a surface lot into a space that feels more connected to its context and welcoming to users. These elements enhance the pedestrian experience, promote community events and activations, reinforce a sense of place, and signal that the facility is designed with people, not just vehicles, in mind.

Placemaking interventions do not need to be large in scale to be effective. Pavement art on BFRs, artistic crosswalks, themed wayfinding signage, or a banner program tied to a local identity can meaningfully distinguish a

facility and strengthen its relationship to the surrounding neighborhood. Designers should look for opportunities to incorporate locally relevant themes, public art, or branding that reflects the community context of the site (**Figure 44**).

4.9.6 Maintenance

Regular maintenance is critical for preserving the safety and functionality of parking facilities. Poorly maintained facilities present significant risks to pedestrians, particularly older adults and people with disabilities, who are especially vulnerable to falls resulting from uneven surfaces, poor lighting, and slippery surface conditions.

4.9.6.1 Maintenance Guidance

Inspect lighting to maintain consistent illuminance levels.

As noted above, facilities should be inspected and cleaned on a regular schedule, and group relamping is recommended.

Inspect and replace signage and markings to maintain desired driver and pedestrian behavior.

Signage and pavement markings should be inspected regularly and remarked or replaced promptly when they are faded, damaged, or missing. Legible markings and signage are essential for encouraging desired driver and pedestrian behavior throughout the lot.

Maintain surface conditions to reduce tripping risk.

Pavement should be inspected periodically for cracks, holes, and surface-level changes resulting from tree root uplift, settling, or ordinary wear. Identified defects should be repaired promptly to reduce pedestrian fall risk and maintain accessibility. Oil and grease buildup should be removed as soon as they are identified, to prevent slip hazards.

Clear snow and ice before peak use periods.

Snow and ice should be cleared from sidewalks, pedestrian routes, access aisles, and key circulation areas before peak use periods. Roof drainage should be directed away from walking and parking surfaces to prevent icing. In addition, when plowing, street snow should be pushed away from green infrastructure, such as swales and rain gardens, whenever possible to prevent road salt and sand from accumulating in these areas.

Trim vegetation to maintain sightlines at conflict points.

Vegetation should be trimmed regularly to maintain clear sightlines at aisle intersections, pedestrian crossings, driveways, and building entrances. Overgrowth that encroaches into walkways or reduces visibility at conflict points should be addressed promptly.

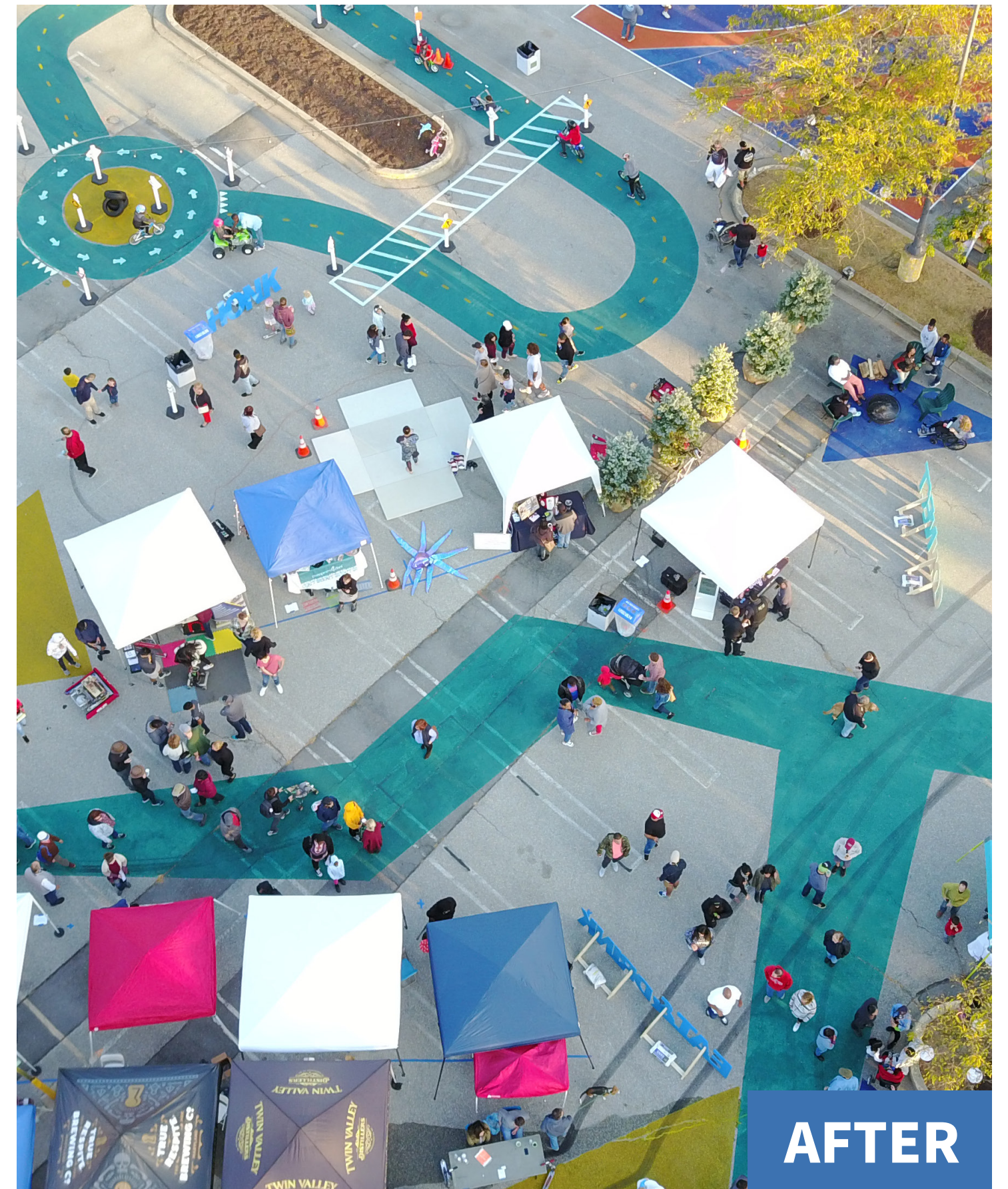
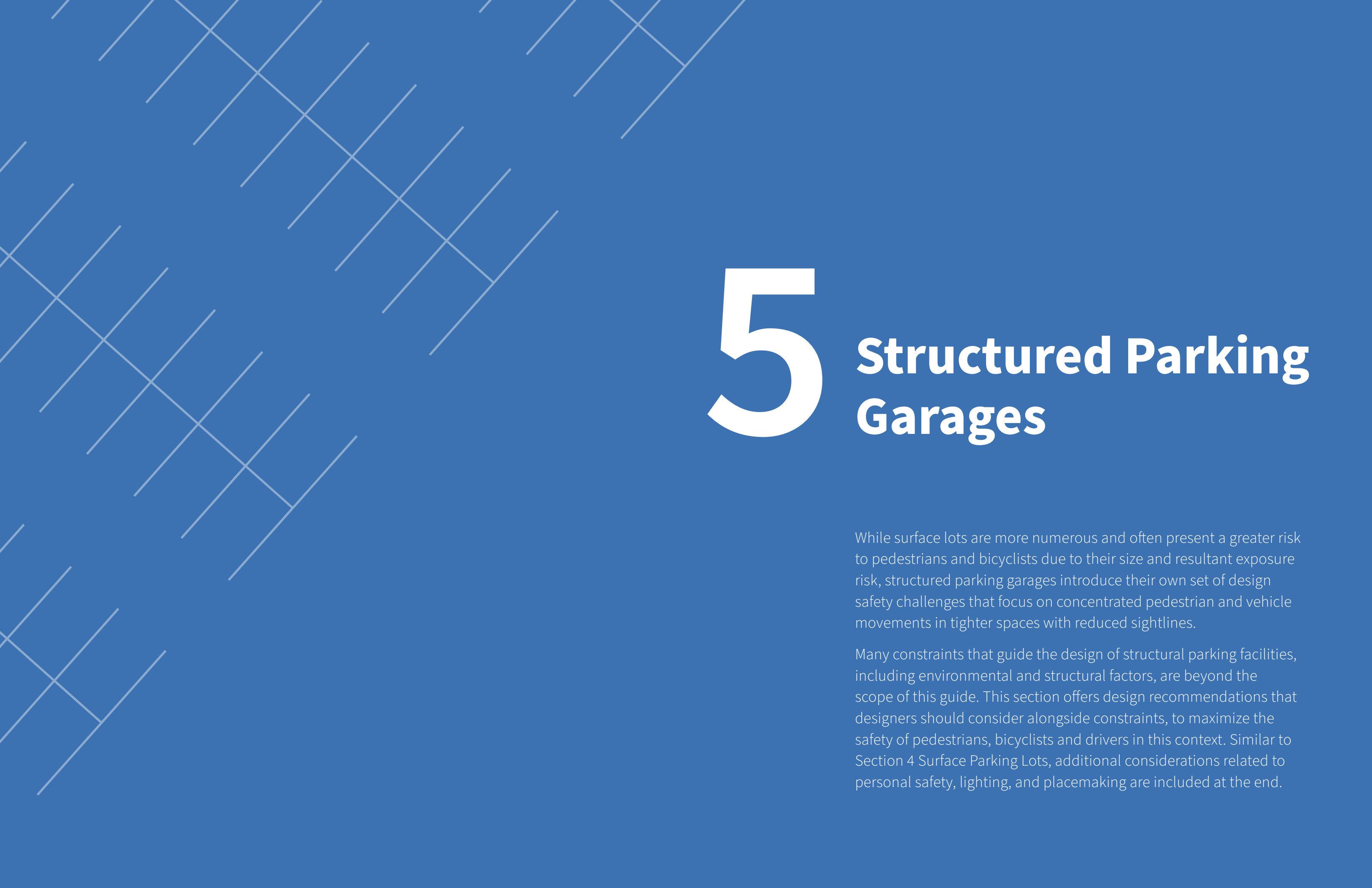


FIGURE 44 Before and after placemaking



5

Structured Parking Garages

While surface lots are more numerous and often present a greater risk to pedestrians and bicyclists due to their size and resultant exposure risk, structured parking garages introduce their own set of design safety challenges that focus on concentrated pedestrian and vehicle movements in tighter spaces with reduced sightlines.

Many constraints that guide the design of structural parking facilities, including environmental and structural factors, are beyond the scope of this guide. This section offers design recommendations that designers should consider alongside constraints, to maximize the safety of pedestrians, bicyclists and drivers in this context. Similar to Section 4 Surface Parking Lots, additional considerations related to personal safety, lighting, and placemaking are included at the end.

5.1 Layout

5.1.1 Layout Requirements

Requirements are described in **Table 4**.

5.1.2 Layout Guidance

The layout of a structured parking facility is the most important determinant of pedestrian safety, as it establishes the relationship between pedestrian and car movements. A well-designed layout directs pedestrians along dedicated, predictable paths and minimizes unnecessary interactions with circulating cars.

Prioritize configurations that reduce visual impacts on the street.

Layout considerations begin with the location and configuration of the parking facility. The selected configuration, underground, internalized within the block, or exposed to the public realm, has implications for the character of the street. Designers should pursue the following configurations in order of preference:

Underground: The preferred configuration is to locate parking entirely below grade. Underground facilities have no visual impact on the public realm, and when access is provided from rear or side streets, their presence is largely imperceptible to people traveling along the street.

Internalized Within the Block: When underground parking is not feasible, structured parking should be located internal to the block and fully enclosed by active uses on all sides. This configuration conceals the garage while activating street frontages.

Exposed to the Public Realm: When a garage must be exposed to the public realm, its design should mitigate visual and experiential impacts through the following measures:

- Parking levels should begin on the second floor, with the ground floor reserved for active uses such as storefronts.
- Active ground floor uses should be provided along all street-facing frontages.
- Exposed façades should incorporate architectural detailing, quality materials, and artwork.

Provide dedicated pedestrian circulation paths.

Pedestrian circulation paths through the facility should connect parking spaces to elevators, stairwells, and building exits, while minimizing interactions with circulating cars. These paths should be physically or visually distinguished from vehicle travel ways and should follow direct, logical routes aligned with pedestrian desire lines.

Align pedestrian paths with desire lines.

Pedestrian paths should be aligned with the most direct routes to elevators, stairwells, and exits. Routes that require pedestrians to deviate significantly from desire lines will likely be ignored and result in pedestrians walking through undesired locations. Key access points for vertical circulation such as elevators and stairwells should be located and distributed to minimize walking distances from parking spaces.

Separate primary vehicle circulation from parking aisles.

Where feasible, primary car circulation routes should be separated from the parking aisles. As seen in **Figure 45**, this configuration keeps primary vehicle circulation separate from pedestrian walkways and reduces vehicle volumes throughout drive aisles.

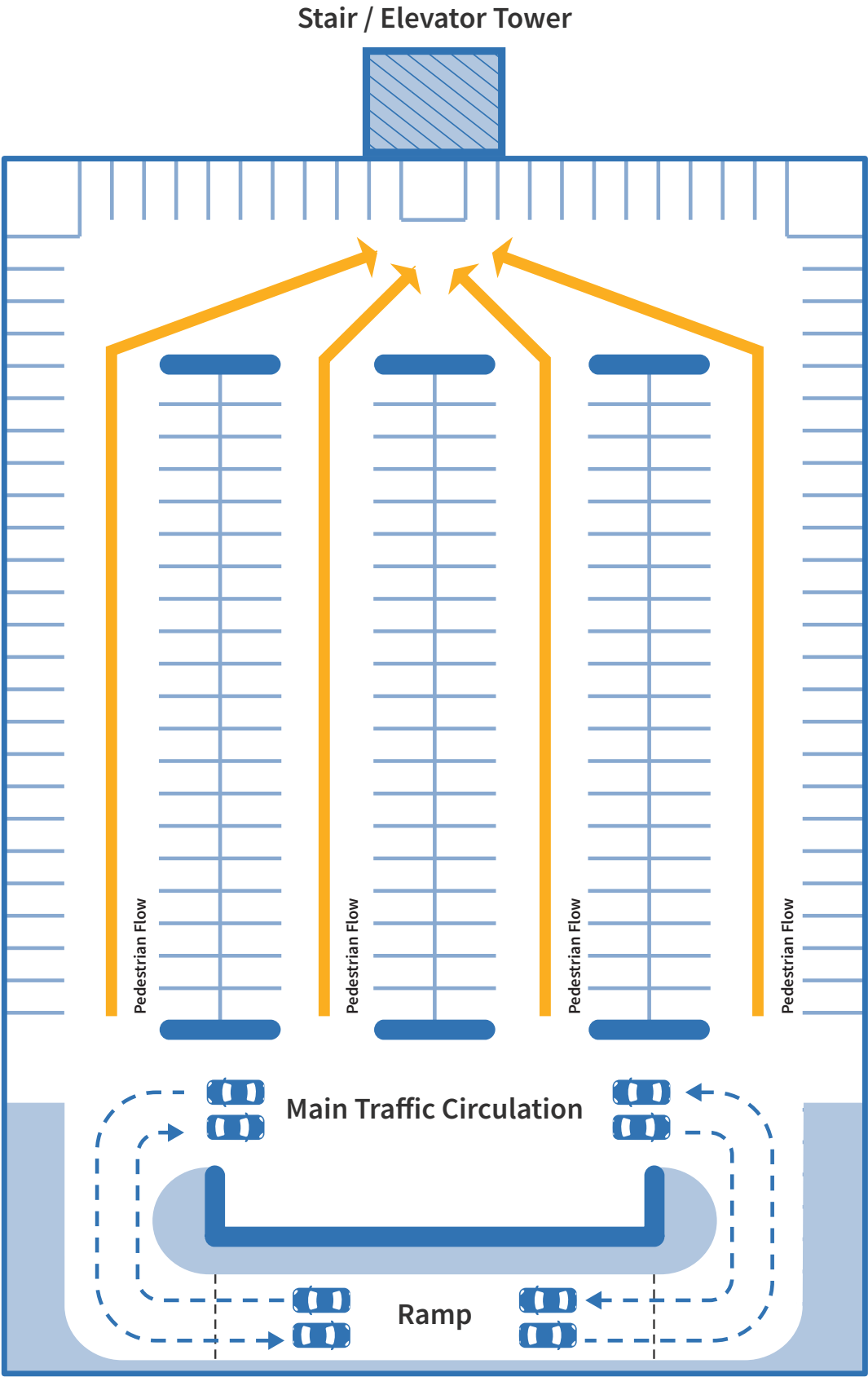


FIGURE 45 Vehicle circulation separate from parking aisles and pedestrian walkways

Design for simple and intuitive car circulation.

Garage layouts should be designed for simple, intuitive car circulation. Complex or ambiguous circulation patterns increase the time drivers spend circulating, raising the likelihood of pedestrian conflict. Clear geometric organization, consistent aisle widths, and legible signage all contribute to a more predictable and safer circulation environment.

Prioritize two-way circulation traffic to improve pedestrian safety.

Two-way circulation is preferred in parking garages, as wider drive aisles improve pedestrian visibility and give drivers more room to navigate around stopped or slow-moving cars. Where site constraints limit available width, one-way circulation may be necessary, as it requires narrower drive aisles and can be easier to fit within limited dimensions. Additional benefits and disadvantages of each circulation type are as follows:

- Two-way circulation provides wider drive aisles that allow pedestrians more separation from circulating vehicles and provides drivers with greater visibility. Two-way facilities also allow for 90° parking stalls, which are preferred over angled stalls as they allow for back-in parking, which provide drivers with greater visibility of circulating pedestrians ~~during backing out movements~~. The primary tradeoff is that wider aisles require more space and may reduce the total number of parking spaces on a given site.
- One-way circulation allows for narrower aisles and angled parking stalls, which can increase parking capacity on constrained sites. While angled stalls make it easier to enter and exit parking spaces, and the intended traffic flow direction is largely self-enforcing, they may contribute to faster circulating speeds. Additionally, one-way systems should not be combined with 90° parking, and complex or poorly signed one-way patterns can increase driver confusion and the time spent circulating—both of which raise the likelihood of pedestrian conflict.

Ensure vehicular ramp design allows for adequate sight distance.

Ramps introduce concentrated vehicle movement and grade changes that can reduce visibility. Ramp designs should ensure adequate sight distance at the top and bottom of all ramps, where cars may be accelerating or decelerating. Walls, columns, signage, and other equipment near ramp landings should be kept low or set back sufficiently to preserve sightlines in both directions. Turning areas at ramp terminations should be kept free of visual obstructions to allow drivers to identify pedestrians before they enter a conflict zone. Where adequate sight distance cannot be achieved through design alone, mirrors or other warning devices should be installed to improve visibility at blind spots and high-conflict locations.

5.2 Pedestrian Network

5.2.1 Pedestrian Network Requirements

Requirements for the pedestrian network are described in **Section 4.5.1. Accessible Route Requirements** and **Section 4.6.1. Walkway and Sidewalk Requirements**.

5.2.2 Pedestrian Network Guidance

Safe and intuitive pedestrian circulation in structured parking facilities depends on the physical design of the garage and its designated pedestrian areas, as well as clear wayfinding to communicate safe routes through the facility. Even in well-designed garages, pedestrians will intersect with car circulation near aisles, ramps, and entrances. A combination of physical separation, thoughtful circulation design, and clear wayfinding is essential to reduce pedestrian exposure to circulating vehicles.

Physically separate pedestrian routes from vehicle aisles.

Pedestrian routes should be physically separated from drive aisles wherever possible by utilizing curbs, railings, bollards, or grade separation. These elements serve to define the pedestrian space, protect pedestrians from circulating cars, improve visibility for both drivers and pedestrians, and reduce the likelihood of conflict in high-traffic areas. Wheel stops or any other physical elements that present a tripping hazard should not be used. Routes should be well-lit and use contrasting pavement textures or colors to reinforce their distinction from vehicle travel ways (**Figure 46**).

Do not position pedestrian walkways in the vehicle backing zone.

Pedestrian walkways should not be located directly behind parking stalls. Positioning walkways within the backing zone of parked vehicles creates a false sense of safety for pedestrians and places them in direct conflict with reversing vehicles. Pedestrians should instead be directed to dedicated walkways away from backing zones.

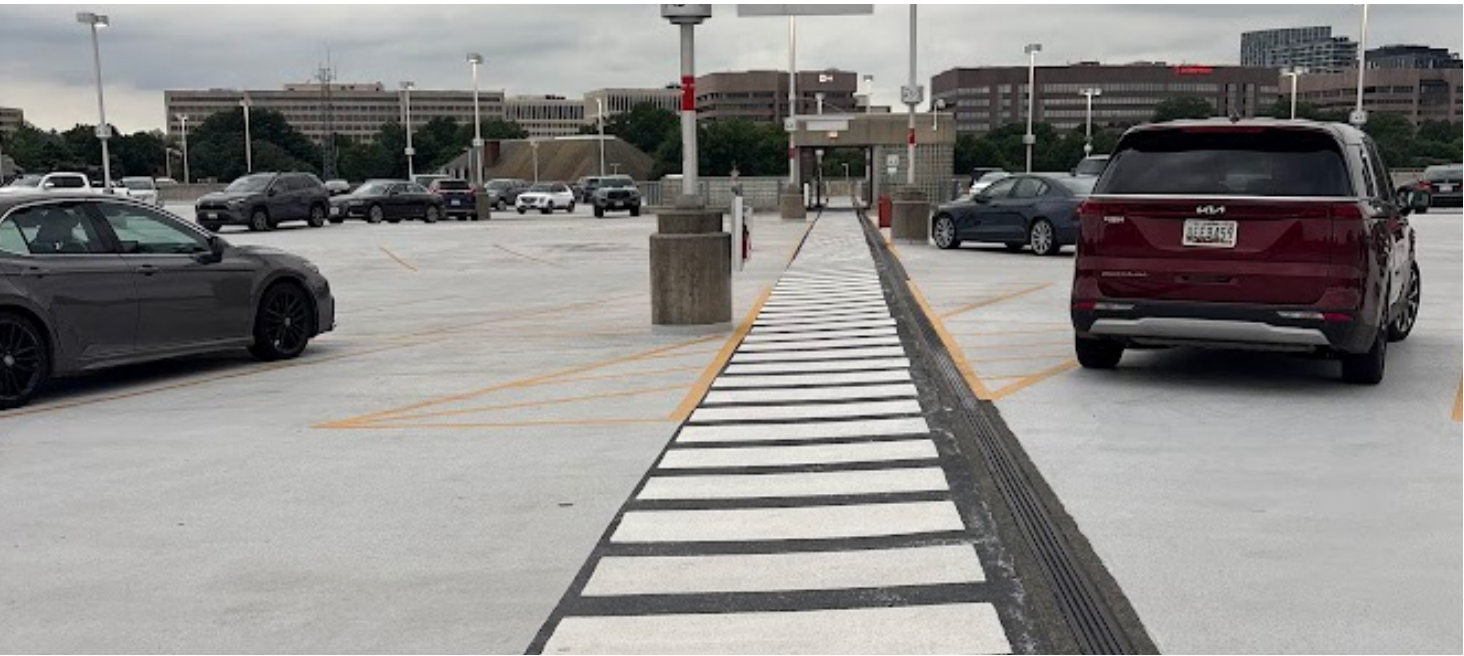


FIGURE 46 Dedicated walkways through parking garage roof

Utilize wayfinding to guide pedestrian safely through parking facility.

Clear wayfinding is essential in structured parking facilities, where limited visibility, absence of distinguishing features between levels and aisles, and constrained circulation spaces can make navigation ~~non-intuitive~~ (Figure 47). Effective wayfinding supports predictable pedestrian movement and decreases the likelihood of unexpected conflicts between pedestrians and vehicles.

Provide exterior signage to guide pedestrians before they enter.

Exterior signage should guide pedestrians to designated building entrances and preferred circulation paths before they enter the facility. This reduces uncertainty at the point of entry and helps direct pedestrians toward safe, planned routes from the outset rather than after they are already inside the facility and potentially encountering circulating cars. Entry points for pedestrians should be distinct from vehicle ingress and egress and provide mode separation (as opposed to expecting pedestrians to enter the facility through a shared driveway.)

Distinguish signs for pedestrians from signs for drivers.

Pedestrian signs should be clearly distinguishable from vehicle signs in appearance, placement, and scale so as not to interfere with vehicle traffic. Pedestrian signs are most effective when they are located perpendicular to traffic flow and placed at the rear of parking stalls, where they are visible to people on foot without competing with overhead vehicular signage. Within the garage, consistent visual cues—including lighting, wall color, surface texture, and overhead signage—should reinforce pedestrian routes and direct users toward elevators, stairwells, and exits.

Use color coding or other wayfinding symbology to aid level identification.

Distinctive wayfinding by level is an effective tool for helping users locate their vehicles and navigate the facility. Each level should be assigned a distinct color or symbology that is applied consistently on columns, walls, and adjacent to elevator lobbies and stairwells. It is recommended to use colors alone or symbols with colors to establish immediately distinct visual classifications. Primary and secondary colors (red, blue, yellow, orange, purple, and green) are recommended. For facilities with more than six levels, white, brown, and black can be added. Colors that are difficult to distinguish from one another should be avoided. Color coding is generally unnecessary in facilities that have three or fewer levels .



FIGURE 47 Wayfinding in parking garage

5.3 Bicycle Parking

5.3.1 Bicycle Parking Requirements

Requirements for bicycle parking are described in ~~Section 4.12. Bicycle and Micromobility Parking Requirements.~~

5.3.2 Bicycle Parking Guidance

Locate bicycle parking near building entrances or elevators.

Bicycle parking in structured garages should be located no more than one level above or below ground level, near building entrances or elevators, and away from primary vehicle circulation routes to minimize interactions between bicyclists and motor vehicles. Where possible, separate entrances or access routes should be provided for bicyclists to reduce conflicts with drivers at garage entrances (Figure 48).

Ensure that bicycle parking areas are well lit and secure.

Bicycle parking areas should be well lit, visible, and within range of security cameras. Where bicycle movements cross vehicle paths, conflict markings or signage should be used to clarify expected movements and increase bicyclist visibility to drivers. Where feasible, bicycle parking should be physically separated from vehicle circulation areas using bollards or curbs.



FIGURE 48 Bike parking near parking garage entrance

5.4 Entry and Exit Points

5.4.1 Entry and Exit Point Requirements

These requirements are described in ~~Section 4.14.1 Driveway Requirements~~.

5.4.2 Entry and Exit Point Guidance

Design entrances and exits to maximize visibility.

Entrance and exit points are typically determined during the entitlement process using traffic data, safety considerations, and proximity to other existing or proposed access points. Entrances and exits should be designed to maximize visibility between drivers and pedestrians and bicyclists traveling along the sidewalk or in adjacent bike lanes. ~~County~~ standard sight distance analysis form needs to be utilized to ensure safety and adequate lines of sight in each direction. Clear sightlines between drivers, pedestrians and bicyclists at these locations are essential to mitigating crash risk, since garage entrances and exits are among the highest-conflict locations in structured parking facilities. Walls, columns, signage, and landscaping near entrance and exit openings should be kept low or set back sufficiently to preserve sightlines in both ~~directions~~. At existing ~~garages~~ visibility can be enhanced through the use of mirrors, and warning signage that ~~warns~~ both drivers and pedestrians of the upcoming conflict point (**Figure 49**).

Where garage entry and entry point intersect with a shared use path or bicycle facility and visibility may be compromised, due to existing structures or horizontal or vertical curves in the road, designer should consider incorporate rumble strips to warns bicyclist and micromobility users of the upcoming conflict.

Use continuous sidewalks and bicycle conflict markings to indicate pedestrian and bicyclist priority.

Continuous sidewalk treatments—where the sidewalk surface and grade extend across the driveway opening—should be used to reinforce pedestrian priority and ~~signal~~ to drivers that they are crossing a pedestrian route. MdMUTCD-approved bicycle conflict markings should be applied where bike lanes or shared use paths intersect ~~with~~ garage entrances and exits to increase bicyclist visibility and clarify expected movements.

Design entry/exit openings to slow motor vehicles and reduce pedestrian and bicyclist exposure.

Entrance and exit openings should be designed to safely accommodate the expected traffic, with designers accounting for truck turning movements if applicable. Narrower widths and tight curb radii (15' recommended) reduce driver turning ~~speeds, shortening~~ the time pedestrians and bicyclists are exposed to potential conflict. At driveways where pedestrians are crossing at street grade, designers should consider the use of traffic calming elements should as raised crossings to further reduce vehicle speeds.

Locate garage entries/exits away from high-pedestrian volume areas.

Where possible, entrances and exits should be located away from areas with high pedestrian volume, such as building entrances and transit stops. At locations where driveways intersect a busy urban street, designers should incorporate buffers on the sidewalk frontage to prevent pedestrians from walking directly adjacent to the driveway entrance.



FIGURE 49 Visibility at parking garage entries and exits

5.5 Other Design Considerations

5.5.1 Lighting

5.5.1.1 Lighting Requirements

TABLE 23 Key Lighting Requirements

Design Element	Criteria	Reference
Roof illumination	Must comply with the requirements in <u>Montgomery County Zoning Ordinance, Article 59.6. Section 6.4.4.B General Outdoor Lighting Requirements</u> , with two exceptions: ▪ A lighting fixture located within 30 feet of the deck perimeter must be 15 feet or less in height. ▪ Any fixture located elsewhere on the deck must be 30 feet or less in height.	<u>Montgomery County Zoning Ordinance, Article 59.6. Section 6.2.9.D</u>
IESNA Compliance	Must certify that exterior lighting conforms to the latest Illuminating Engineering Society of North America (IESNA) recommendations (Model Lighting Ordinance-MLO: June 15, 2011, or as superseded) for the development type.	
Fixtures	All onsite down-lights must have full cut-off or BUG-equivalent fixtures.	
Deflectors	Deflectors must be fixtures to prevent excess illumination and glare.	

5.5.1.2 Lighting Guidance

Lighting in structured parking facilities serves both traffic safety and personal security functions and is particularly critical given the enclosed nature of garages, which limits natural light and creates areas of reduced visibility. Lighting should be designed and maintained to the following standards.

Distribute lighting uniformly.

Lighting should be distributed uniformly across all parking levels, pedestrian paths, elevator lobbies, and stairwells. Large contrasts between brightly lit and dark areas impair the eye’s ability to adjust and create discomfort and increased risk for both drivers and pedestrians. Uniformity is as important as overall illuminance levels.

Provide sufficient vertical illuminance.

Sufficient vertical illuminance should be provided throughout the facility to ensure that faces, signs, and pedestrian movements are visible at standing height. This is particularly important along pedestrian routes, at elevator lobbies, and at stairwell entrances where personal security concerns are highest. ~~Photo illustrating lighting guidance~~

Minimize glare.

Glare should be minimized through appropriate fixture selection and placement, particularly on ramps where oncoming headlights and artificial lighting can combine to impair driver visibility, and near pedestrian crossings where contrast and depth perception are critical.

Apply light-colored, reflective finishes to ceilings and structural surfaces.

Light-colored, reflective finishes should be applied to ceilings and structural surfaces throughout the facility. White-stained concrete is a cost-effective option that increases reflectivity and improves overall brightness in the facility without relying solely on additional lighting fixtures. This improves both actual illuminance levels and users’ perceived sense of safety and comfort.



FIGURE 50 Example of insufficient lighting in parking garage impacting feeling of safety

5.5.2 Placemaking

While the overall aesthetics of structure parking facilities is beyond the intent of the guide, designers should be aware of opportunities to incorporate aesthetic considerations that improve users experience and the facility’s relationship to its surrounding context: primarily by incorporating art, murals, greenery, and other visual features into both the interior and exterior of a garage.

Within the facility, murals, themed wayfinding elements, and green features such as green walls can reduce the visual monotony of exposed concrete, improve pedestrian navigation, and create an environment that feels more welcoming instead of purely functional.

On the exterior, garages exposed to the public realm have an opportunity to contribute positively to the streetscape. Architectural detailing, artwork, and murals on exposed façades on above ground, unenclosed garages, can help reduce the visual impact of what may otherwise be a large, blank building mass. Designers should look to the surrounding neighborhood for locally relevant themes, materials, and artistic traditions that can inform façade treatment and ground-level design.

Facilities that prioritize aesthetic quality and visual interest are more likely to be considered for alternative and flexible uses beyond daily parking. A facility that feels welcoming and is visually well-integrated into its community context may be a more natural candidate for programming and activation. For example, rooftop levels may serve as venues for community events, markets, or other public activations that extend the facility’s value beyond parking.

5.5.3 Personal Security Guidance

Personal security in structured parking facilities depends on both reducing actual crime risk and improving users’ sense of safety. Crime Prevention Through Environmental Design principles provide an effective framework for achieving both goals and should be applied throughout the facility ~~(Figure 501).~~

Design for natural surveillance.

Stairwells, elevator lobbies, and pedestrian routes should be kept visually open to the parking areas wherever feasible. Enclosed spaces that limit sightlines create opportunities for crime and reduce perceived safety. Where spaces must be enclosed for fire protection or due to weather, use transparent materials such as glass walls to preserve visibility. Stairwells and elevator cores should be located along perimeter walls wherever possible, allowing visibility from adjacent streets and public spaces. Short-span structural systems, in which columns are placed in closer proximity, are discouraged, as the increased column density obstructs sightlines and creates additional visual barriers throughout the facility.

Stairwells should be open or glass-enclosed and visible to adjacent streets wherever possible. Stairwells are typically located in dead corners of the facility, making visibility and enclosure treatment particularly important in these locations.

Elevators should be positioned at the end of the facility closest to the primary pedestrian destination, so that users naturally pass them as they head toward their destination. Glass-backed elevators are strongly recommended, as they maintain visibility into and out of the elevator. On exposed upper levels, enclosed lobbies should be provided to protect users from the elements.

Keep stairwells and elevators access points open at all times.

Stairwells and elevators should always remain accessible on all levels. Locking stairwells on certain floors forces pedestrians to use vehicle ramps or other undesignated routes, creating dangerous conflicts with circulating vehicles. Where security concerns require controlled access, access control measures should be applied in a manner that does not redirect pedestrians into vehicle circulation areas.

Concentrate pedestrian activity along well-defined, predictable routes.

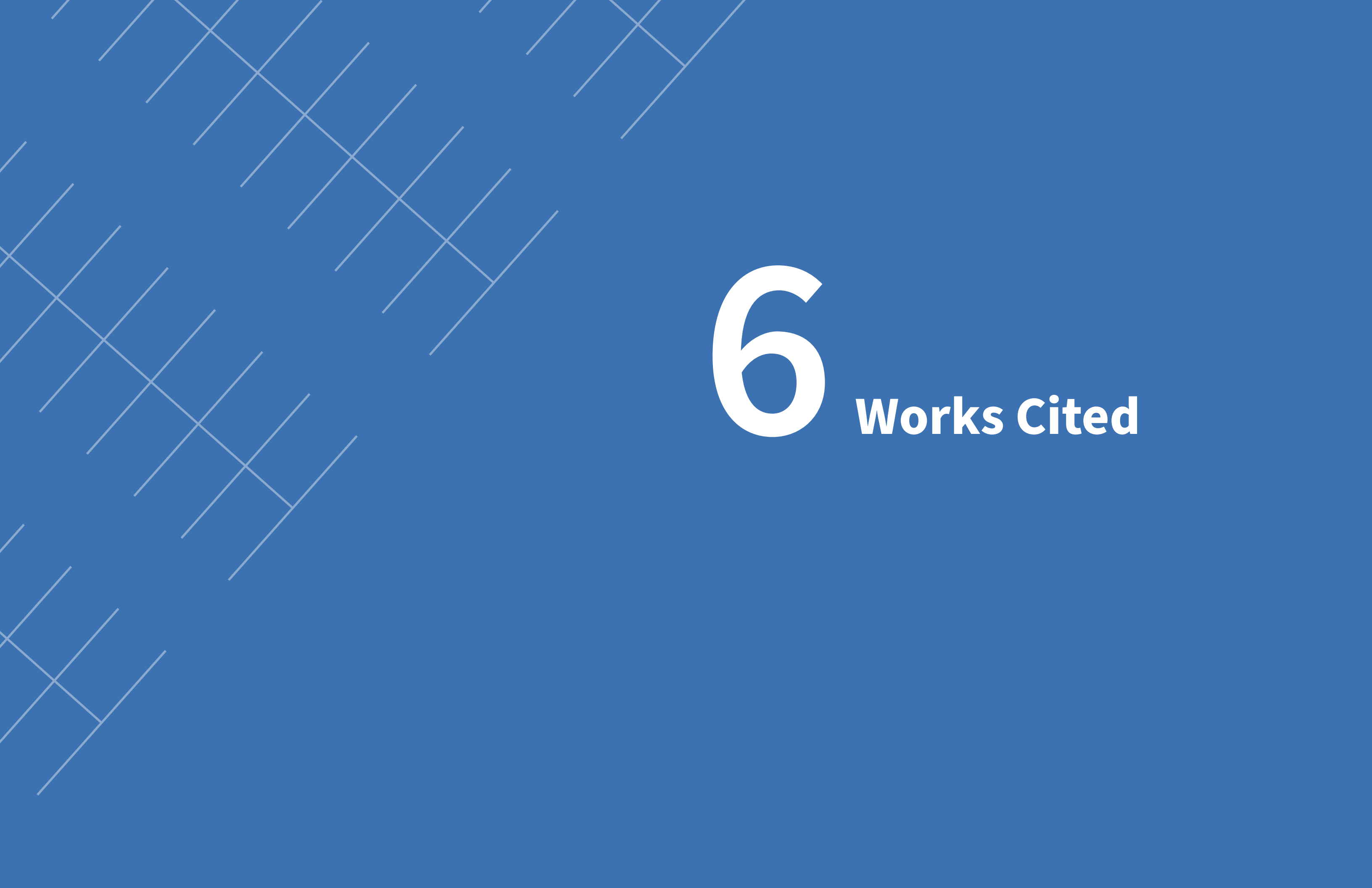
Clear, direct routes to vertical circulation cores increase the density of pedestrian activity along key paths, improving passive oversight. Dispersed pedestrian movement reduces natural surveillance by spreading activity across the facility.

Install security cameras.

Security cameras should be provided at all garage entrances, along pedestrian routes, and at bicycle parking areas. Camera placement should be coordinated with a lighting design to ensure adequate image quality throughout the facility.

Provide routine maintenance.

The facility should be maintained to a high standard of cleanliness and repair. Graffiti, broken fixtures, and accumulated debris negatively affect perceived safety and should be addressed promptly.



6

Works Cited

Works Cited

Alhajaj, Nawaf. “Assessment of Walkability of Large Parking Lots on University Campuses Using Walking Infrastructure and User Behavior as an Assessment Method for Promoting Sustainability.” *Sustainability*, vol. 15, no. 9, 2023, article 7203. MDPI, <https://doi.org/10.3390/su15097203>.

Kueper, Daniel A., et al. Pedestrian and Bicyclist Safety in Parking Facilities. Institute of Transportation Engineers, 2017.

O’Brien, Sarah Worth, et al. *Yielding Compliance at High Visibility Crosswalks*. North Carolina Department of Transportation, Research and Development Unit, 6 May 2022, FHWA/NC/2019-18.

University of Kansas Research & Training Center on Community Living. Parking Equity: Deterring Access Aisle Parking Violations. 30 June 2017, Accessible Parking Coalition, accessibleparkingcoalition.org/wp-content/uploads/response-15-Deterring-Access-Aisle-Violations-updated-taggingfact-sheet.pdf.

Rundle, Andrew, et al. A National Study on the Comparative Burden of Pedestrian Injuries from Falls Relative to Pedestrian Injuries from Motor Vehicle Collisions. *J. Urban Health*, 2024.

Turner, Shane, Arie Roozenburg, and Tim Francis. *Predicting Accident Rates for Cyclists and Pedestrians*. Land Transport New Zealand, 2006.

